SPLASH!

Stormwater Pollution: Learn and Share

City of Eugene Stormwater Management Program

A Local Water Quality Curriculum

Grades K-8

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In cooperation with:
City of Eugene
Public Works
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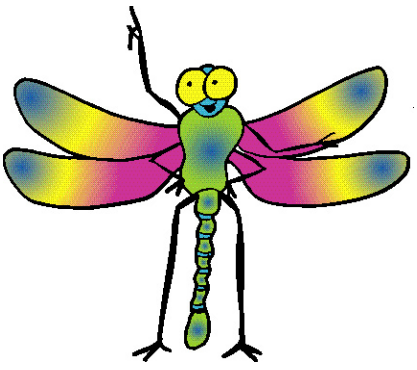
Introduction

"Lily"



"Dougie"

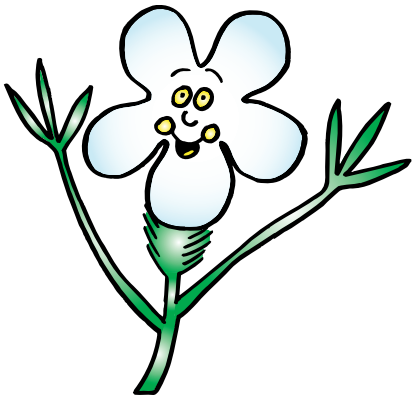
The Stormwater Pollution: Learn and Share (SPLASH) curriculum was developed for use by educators in the local Eugene/Springfield area. Although many water units stress the value of clean, safe water, this unit encourages students to explore their local water resources and increase their awareness of water quality. Stormwater (rain that runs off hard surfaces directly into our creeks and rivers) plays a large role in Eugene's water quality. Our goal is to change students' habits and attitudes; through education we hope to build a community of responsible water users.

The lessons included in the elementary curriculum are designed to develop an awareness of the basic water cycle, Eugene's three water systems including the stormwater system, personal water use, local water sites and the affect pollution has on plant and animal life. In the intermediate curriculum the students will review earlier water concepts and study local ecosystems and community issues surrounding them. Primary teachers may want to use or adapt lessons from the intermediate level curriculum if appropriate for their students. Intermediate teachers may want to consult the primary unit as they plan for their students' learning. The activities included in the middle school curriculum are designed to develop an awareness of how human use affects stormwater, wetlands, and the watershed in the Eugene area.

The activities in SPLASH foster direct student participation, enhance critical thinking skills, and address a variety of learning styles. Activities include making models and maps, observing and recording, graphing, writing, guest speakers, art, and field trips. While this is an integrated unit, many of the experiments found in these lessons make use of the scientific process. Every effort was made to have students make predictions, observe results, record data and draw conclusions. SPLASH encourages students to make a direct connection between their water use habits and the impact to people, wildlife and our local waterways.

Appearing throughout the text is "Lily," the Pacific Green treefrog and mascot for the *SPLASH* program. Lily also has new "friends" who will help her convey to students the importance of keeping stormwater clean. Dougie the dragonfly, Rex the kingfisher, and Patty the popcorn flower represent plants and animals that live in the wetlands. Drippy the raindrop also helps explain the water cycle. We hope that by linking Lily and her friends with stormwater, students will realize the importance of keeping "Lily's pad" free of pollutants.

"Rex"



"Patty"

The SPLASH curriculum can be taught in approximately two to three weeks of 30-45 minute daily lessons. The 1st grade through 5th grade units were written to be used as an extension of the science kits used at those grade levels. Many of the lessons and activities were developed to fulfill the requirements of state benchmarks. Lessons were designed in a consistent manner. Each unit has a concept overview and lessons that address an aspect of the concept. Teachers receive a kit with necessary materials and procedures for *SPLASH* activities along with the curriculum. Many lessons include extension activities which may be used with the class or with individual students. Students handouts accompany each lesson. Supplemental activities, interactive computer games, videos, literature, guest speakers, websites and field trips are referenced in the Additional Resources section at the end of the curriculum. For more information about this unit, or to make advance scheduling for special resources, call Eugene Public Works, Stormwater Management Program at 682-2739.

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Kindergarten Unit "What is Water?"

Objective: To introduce kindergartners to the basic concepts of water, where it comes from and why it is important in their lives.

Lesson 1: Where does water come from?

Water is all over the earth. It is in rivers, lakes and oceans. When the sun heats the water in the rivers, lakes, and oceans, the water turns into clouds. The clouds you see in the sky are made up of millions of water droplets. When the water droplets become big and heavy, they fall from the clouds to the earth. If it is warm outside, the water falls as rain. If it is cold outside, the water falls as snow. When the rain or snow falls on the earth, it waters the trees and plants and fills the rivers, lakes and oceans.

Activity 1: *Play the Rain Game.* Hand out the Rain Game headbands (sun, clouds, rain) and have the kids color them with crayons. Have kids divide up into sun (1 child), rain drops (many children), and clouds (many children). Explain in simple terms how the water cycle works: the sun chases water to the clouds, water (rain) falls from the clouds back to earth. Let the sun chase the rain into the clouds and then have the rain "fall" from the clouds back to the ground. Allow the children to take on different roles (sun, clouds, rain).

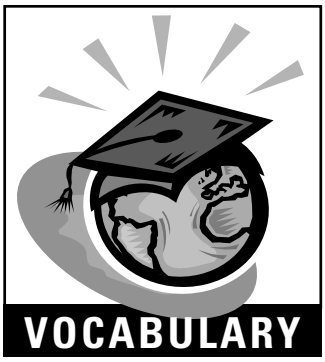
Lesson 2: Why is water important?

All living things (plants and animals) need water to live. We drink water every day. Fish live in water. Plants need to be watered. What happens when you forget to drink water? What would happen to fish in an aquarium if you took out all of the water? What would happen if you forgot to water your plants?

Discuss the difference between a desert and a rain forest and how water affects what can live in each habitat. Compare the types of plants and animals that live in a desert and rain forest. Could they switch places (e.g., could a cactus live in a rain forest or an orchid live in the desert)?

Demonstration: Show students pictures of a desert, tropical rain forest, and ocean. Explain how the plants and animals live in different conditions (dry, wet).

Demonstration: Read a story to students. Choose a book that tells the story of an animal in one of the habitats mentioned above. Hand out coloring pages that show plants and animals that live in different habitats. Have students color the plants and animals.



sun
lake
ice
plant
cloud
river
snow
animal
rain
ocean

Lesson 3: How do we use water everyday?

Brainstorm: Ask children how they use water everyday. They may include water activities. Use handout provided with pictures of children using water. Some examples include: drinking, bathing, brushing teeth, swimming, cooking, blowing bubbles, painting with water colors, having pet fish.

Handout: Give students the handout showing kids doing water activities. Discuss each activity.

Activity 1: Using watercolors, have students paint a picture of their favorite water activity. Explain how water colors work.

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1st Grade Unit: "Water Forms"

Objective: To introduce 1st grade children to the concept of water in different forms (solids and liquids) and that rainwater can carry pollutants into streams, rivers and ponds. This unit was developed to be used as an extension of the Solids and Liquids Science Kit.

Lesson 1: What is water?

Water is a liquid we drink. When water is pure (clean) it does not smell, taste or have color. There is water in rivers, lakes, oceans, and in our bodies.

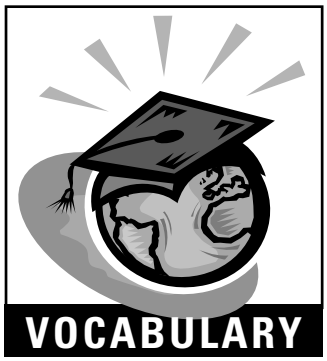
Water comes in three forms:

- Liquid: rivers, lakes, oceans, from the faucet
- Solid: ice, snow
- Vapor: invisible gas that condenses into fog or clouds

Temperature (hot and cold) changes the form of water. What happens when water gets cold? Does it become ice or snow? What happens when water gets very hot? Does it form steam clouds?

Activity 1: *Water forms*. Have students do this simple experiment which demonstrates water in solid and liquid forms, along with evaporation.

Give each student a paper cup containing an ice cube. Ask the students what the ice cube is made of and then have students put the cup in a warm place or in a sunny window. Ask them what they think will happen to the ice cube. Have students check their cups after one hour. Ask them what happened to their ice cube. Next, put the cups aside and leave them until the water has evaporated. Before setting the cups aside, ask the students what they think might happen to the water. Once the water has evaporated, have students examine the cups. Ask them what happened to the water and compare their answers to what they thought would happen.



water
ice
snow
liquid
solid
river
oil
pollution

To demonstrate condensation, boil water and hold a small mirror above the pot. Discuss how heat (like the sun) turns water into a vapor and how the vapor condenses (as it does to form clouds) on the mirror.

After the experiment, make popsicles to show how water turns to ice when it gets very cold. Have students eat their popsicles!

Lesson 2: What plants and animals live in or near water?

Many animals live in water or must be near water to survive. For example, fish must live in water to survive, because they can get oxygen from the water. Beavers live in the water for part of the time, but must breathe air outside of the water to survive.

Water lilies must have their roots in the mud at the bottom of the pond, but also need sunlight to survive. Some plants, like algae, live in the water all of the time.

Brainstorm: Make separate lists of plants and animals that live in or near water. Discuss how each one uses water and needs to survive.

Activity 2: *Color.* Have students color in the *Lily and her Friends* coloring book.

Activity 3: *Create a wall mural.* Make copies of some of the pictures from the coloring book. Draw a pond or stream on a chalk board with colored chalk. Have students create a wall mural, taping the pictures in the appropriate place on the board.

Lesson 3: What happens when water gets polluted?

In the last lesson, students learned that plants and animals need water to survive. What happens when the water becomes polluted? How does water become polluted? Can plants and animals live in polluted rivers and streams?

One of the most common forms of pollution is stormwater pollution. It can be easily seen in streets and parking lots. The storm drains carry the water and pollutants directly to local creeks and rivers. Many pollutants are carried with rainwater into storm drains. For example, rainwater can pick up oil and other fluids that leak from cars, fertilizers and pesticides used in yards and gardens, along with trash and litter. This pollution can harm plants and animals and make water unsafe for drinking or swimming.

Activity 1: *Storm drains.* Hand out a picture page showing storm drains and pollutants. Explain that the trash in the storm drain pictured goes directly to the river. Have students identify the pollutants in the pictures.

Activity 2: *Parking lot field trip.* Take students to the school parking lot and show them a storm drain. Have students identify any pollutant nearby that could be carried with rainwater down the storm drain. Examples include oil or other fluid from cars, dirt, cigarette butts, or litter. Explain that all of these pollutants can harm plants and animals. To introduce the next activity, be sure to point out oil that has leaked from a vehicle.

Activity 3: *How do pollutants harm animals?* Many animals live in or near water. Some kinds of birds build nests next to streams or

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ponds. Show the students a picture of a bird nest near water and a picture of a baby bird in an egg. To illustrate how pollutants can harm birds, do the "There's Oil in My Egg!" experiment.

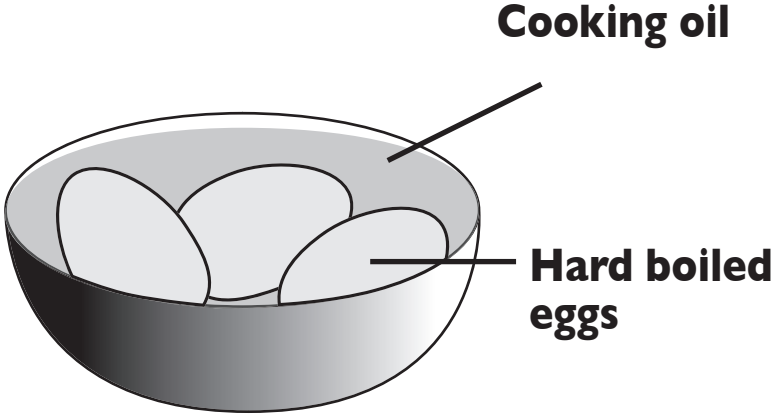
Materials:

- 3 hard-boiled eggs
- small bowl
- cooking oil (preferably a darker oil)

Procedure:

Place the hard boiled eggs in the bowl and pour enough oil in the bowl to cover the eggs. Place the bowl in a well-lit area and have the students observe the eggs. After five minutes, remove one egg from the bowl and place it on a paper towel. Let students examine the egg. Wipe off the excess oil from the shell. Ask the students what they think will happen when you peel the shell off the egg. Peel off the shell. Let the students examine the egg and see how the oil has soaked through the shell. Ask them how the oil might harm the baby bird (would the baby bird be smothered by the oil?) After 15 minutes, peel the shell off the second egg. Have students examine the egg. Did more oil soak through the shell? After 30 minutes, peel the third egg and repeat the examinination and discussion.

After the experiment, have students look at the storm drain pictures on their handout and identify oil as a pollutant. Explain again that the storm drains carry pollutants to local creeks and rivers.



Oil in water can harm plants and animals. This experiment illustrates how oil can penetrate egg shells and potentially harm baby birds.

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2nd Grade Unit "Stormwater Pollution"

Objective: To introduce 2nd grade children to the concepts of stormwater, porous and impervious surfaces. This unit also explores what pollution is and how it can harm the environment and how soil can be a factor in keeping pollution out of local waterways. This unit was developed to be used as an extension of the Changes and Soils Science Kits.

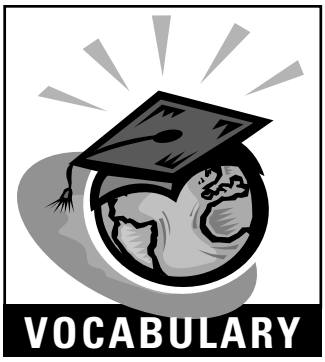
Lesson 1: What is stormwater pollution? How does it change water quality in rivers, streams and lakes?

What is stormwater and what is stormwater pollution? Stormwater is rain and surface water that runs off nonporous (impervious) surfaces and flows through open ditches or underground pipes directly into streams and rivers. In cities, stormwater runs off streets, sidewalks, roofs and parking lots. All of these surfaces are solid and rain cannot soak into them like it can soak into the ground. These surfaces are "impervious." When rain runs across these impervious surfaces, it collects pollutants like oil, grease, dirt, fertilizers, animal waste and litter and carries them into the storm drain. These pollutants are carried with the rain directly to streams and rivers. Stormwater DOES NOT get cleaned before it goes back into the river!

We use our rivers for many activities like swimming, fishing, and boating. Some cities get their drinking water from rivers. Wild animals also drink from creeks and rivers. So, it is important that we keep rivers clean!

Exercise: Take students into the school parking lot on a rainy day and have them observe a storm drain. Do they see any pollutants being carried along with the stormwater down the drain? Have the students compare what happens to rain that falls on the lawn to rain that falls on the pavement. Does the rain soak into the pavement? Does it soak into the lawn? Explain that the grass growing in soil has roots that can soak up water like a sponge and the that soil filters the water.

Handout: Hand out the storm drain pollution picture page. Have students identify trash and pollutants that are in the water. Explain that the storm drains they looked at in the parking lot are connected to underground pipes (like the pipe in the picture) and that the trash and



drinking water
runoff
water treatment
storm drain
wastewater
pollutants
oxygen
stormwater
filtration
amphibian

pollutants were carried with stormwater through the pipe and dumped into the river.

Demonstration: Using Enviroscape (available from the City of Eugene, 682-2739), demonstrate how stormwater runoff flows across impervious surfaces. After adding pollutants to the Enviroscape model, sprinkle water over the pollutants and have students observe how the pollutants are carried along with the stormwater into the stream. Ask the students how the pollutants change the water in the stream. Does the color of the water change? Is the water dirty? To explain how soils soak up water, place a sponge on the Enviroscape surface. Slowly sprinkle water on the sponge and have students observe that the water stays in the sponge and does not run off. Explain the difference between an impervious surface (parking lot) and a porous surface (lawn) and that porous surfaces can soak up water (like the sponge).

Activity 1: Hand out the "Help Keep our Rivers Clean" coloring page. After the students have finished coloring, tape the finished pages on the wall and ask them the following questions:

Do they see any activities on the coloring page that may hurt the fish and ducks in the stream.?

Where will the oil being dumped in the street go?

Brainstorm: Discuss storm drains and storm drain systems. Ask students to look for storm drains as they walk home from school, are on the school bus or in a car. Did they see any pollutants or trash in the streets or gutters that could be washed down the storm drain? Make a list of any trash or pollutants they saw on the chalk board. Identify local water sites that storm drains empty into (Amazon Creek, Willamette River).

Lesson 2: What are pollutants and how do they harm plants and animals?

Pollutants are anything that damage our water, air, and soil. Pollutants are often harmful to humans, plants, and animals. Most pollution is caused by people, but some pollutants are natural. Some pollutants are easily seen. For example, it is easy to spot litter or an oil slick on a pond. However, many pollutants cannot be seen. It is important to realize that clear water isn't necessarily free of pollutants. The pollutants can only be detected by testing the water.

Pollutants can cause many types of problems for humans, plants, and animals. When pollutants like oil enter our rivers, lakes, and streams, the oil can kill fish and make the water undrinkable for animals. Another example of a pollutant is dirt, which enters the storm drains from construction sites. The dirt makes the water muddy, and fish cannot live in muddy water! Fertilizers entering our water system can cause plants like algae to grow in excess. The algae uses up lots of oxygen in the water, leaving very little oxygen for the fish. Some pollutants can cause tumors and growth defects in fish and amphibians (frogs).

Handout: Hand out a picture page showing organisms that have been harmed by pollution. Discuss the importance of keeping water clean.

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Lesson 3: Can soil clean the water?

During their visit to the parking lot, students observed that rainwater flows off impervious surfaces into storm drains, which carry pollutants directly into local waterways. But what happens when those pollutants flow into lawns and other planted areas? Rainwater that falls on planted areas soaks into the ground just like the sponge soaked up the water in the Enviroscape model. Ask the students if the ground can clean the water if the water is polluted.

Activity 1: *Exploring Water Filters*. By watching this simple demonstration, students can see that pollutants in water can be filtered by soils.

Materials:

- 3 glass jars
- 1/2 cup of sand
- food coloring
- 2 plastic funnels
- 1/2 cup of potting soil
- coffee filters
- measuring cup
- 2 teaspoons of oil

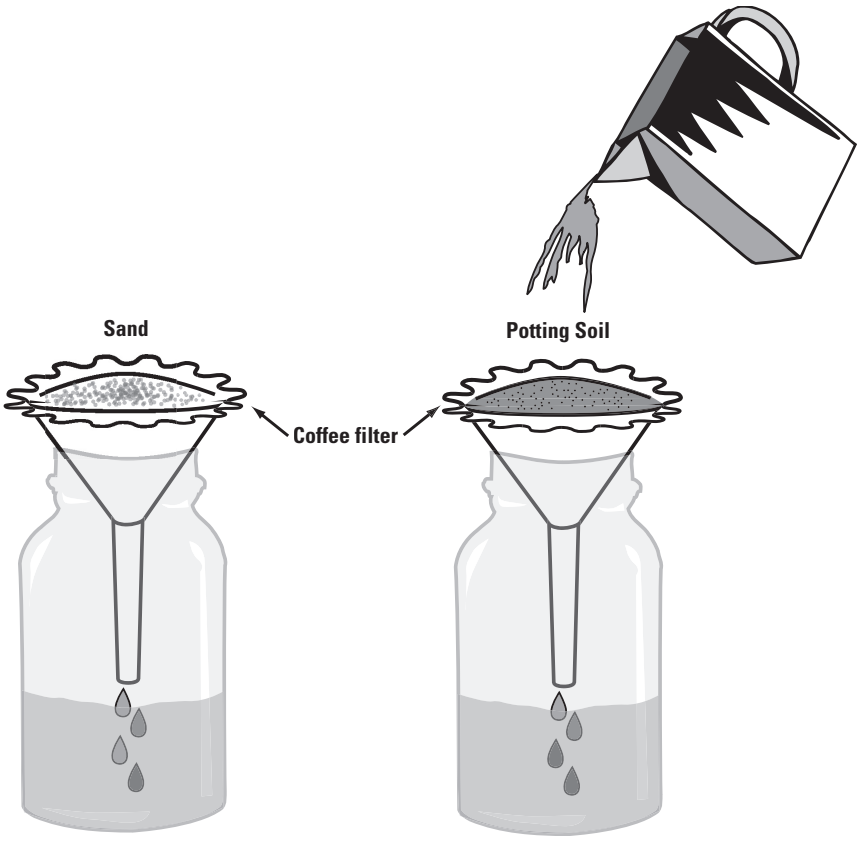
Create soil filters by lining each funnel with a coffee filter. Fill the first funnel half-way with sand; the second funnel half-way with potting soil. Place each funnel over an empty jar. In the third jar, mix three drops of food coloring with 1 cup of water. Pour half of the mixture into the funnel with sand, the other half into the funnel with potting soil. After the water has filtered through both funnels, record student observations of what they see in the jars.

Empty the two jars and repeat the experiment using a mixture of water and oil.

Record the students' observations on a worksheet and then ask the students the following questions.

1. Which is a better filter: sand or potting soil?
2. Which substance (colored water or oil) was easier to filter out?
3. Where are the "pollutants" that were in the water?

Brainstorm: What are some things that can be done to help keep stormwater clean?



Using sand and potting soil, students can observe how soil can filter pollutants from water.

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3rd Grade Unit "Pollution and Plant Growth"

Objective: *This unit explains that pollution cannot always be seen and that polluted water can harm plants and affect plant growth. This unit was developed to be used as an extension of the Plant Growth Science Kit.*

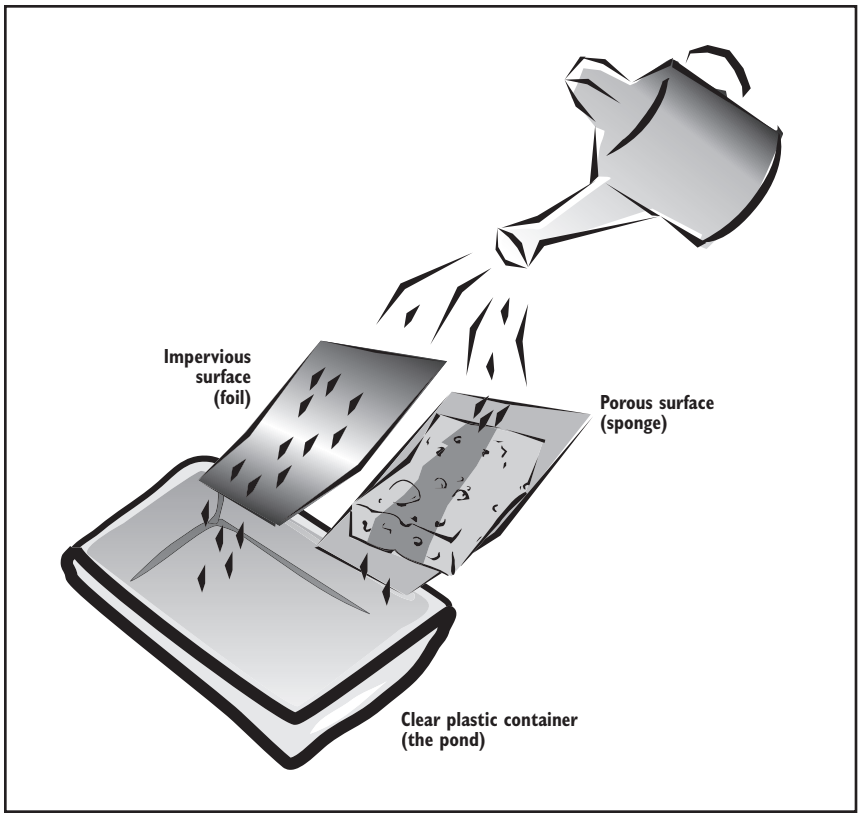
Lesson 1: What happens when precipitation hits the ground?

The earth is made up of land and water. When it rains or snows, precipitation can fall back into lakes, rivers, streams and the ocean. Precipitation also soaks into the ground, where it is used by plants for growth. Precipitation that soaks into the ground is referred to as groundwater. Some precipitation falls on impervious surfaces, such as roofs, paved roads, and parking lots. Water cannot soak into the ground through an impervious surface, so it often runs into local storm drains. When water runs off impervious surfaces into storm drains, it is called stormwater. Stormwater flows down a storm drain and into a network of pipes that eventually empty directly into a stream or river. Stormwater is not "cleaned" before it discharges into local waterways. Anything (oil, leaves, soap suds, dirt, garbage) that washes down the storm drain with stormwater goes directly into local wetlands, rivers, lakes, and streams.

Activity 1: *What is an Impervious Surface?* Demonstrate runoff. Using a simple model, illustrate and explain the difference between an impervious surface and a porous surface. Materials needed:

- two 4 x 6 pieces of tagboard
- 1 clear plastic square container
- 1 sponge
- watering can
- aluminum foil

Create an impervious surface by wrapping 1 piece of tagboard in aluminum foil. Attach the sponge to the other piece of board. Fill the plastic container (the pond) part way with clean tap water. Prop up the two boards so water can run off the boards into the plastic



This simple experiment demonstrates the difference between porous and non-porous (impervious) surfaces.

container. Sprinkle water over the foil-covered board and let it pour into the pond. Explain to students that water cannot soak into an impervious surface. Next, pour water onto the board with the sponge. Discuss what happens to the water. To demonstrate how stormwater runoff can carry pollutants into local waterways, sprinkle cocoa on the foil-covered board and pour water over the cocoa. As the water mixes with the cocoa, it will become murky and pollute the pond. Next, put some cocoa on the sponge and sprinkle the sponge with water. The sponge absorbs the water and cocoa mixture. Explain to students that the ground is like a sponge and can absorb water and pollutants.

Brainstorm: Have students list examples of impervious surfaces. Remember, an impervious surface is any surface that cannot absorb water. Have students list pollutants that can be carried with stormwater down a storm drain. (Examples include fertilizers and pesticides from our yards, oil from our cars, litter thrown in the street, and animal waste).

Lesson 2: What's in the water?

We use water every day for drinking, cooking, bathing and recreation. What happens when water becomes polluted? How does pollution harm people? How does pollution harm plants?

Many pollutants are obvious to the naked eye. It is easy to see garbage or debris floating in the water, water with soap suds, or the sheen of oil on the water's surface. However, what happens when pollutants mix with water? Are they still in the water? Explain to students that pollution cannot always be seen and that invisible pollutants can still be harmful.

Safety Alert! Teachers, please remind students to never taste anything in a science class unless it is a controlled experiment supervised by an adult!

Activity 1: *What's in the water?* To demonstrate that clear water is not always free of pollutants, this experiment lets students "taste" pollutants that have been dissolved in tap water.

Materials:

- Clear plastic cups
- Sugar
- Salt
- White Vinegar
- Lemon Juice
- Cotton swabs
- Water

Place tap water in 5 plastic cups. Stir 2 Tbs. sugar into cup #1, 2 Tbs. white vinegar into cup #2, 2 Tbs.salt into cup #3, and 2 Tbs.lemon juice

in cup #4. Do not add anything to cup #5. Using cotton swabs, let each student taste the water from each cup. Can the students identify "the pollutants" dissolved in each cup? Why couldn't they see the pollutants?

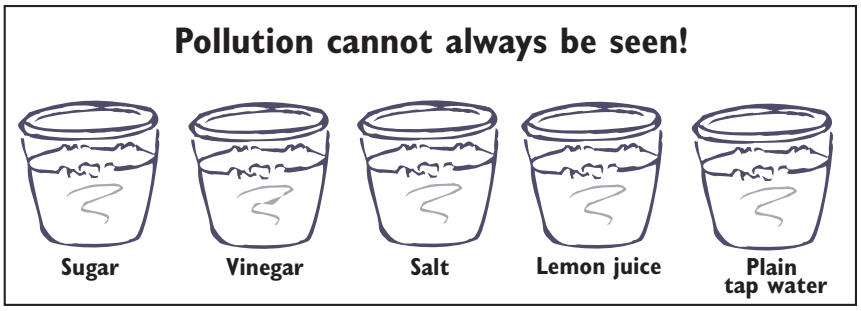
Brainstorm: List common water pollutants on the chalkboard and discuss where they come from. Have students copy the words from the board. Identify pollutants that can be seen and discuss that some pollutants cannot be seen, but are still harmful. Can students think of any pollutants that may mix with water and not been seen? (Examples may be pesticides, fertilizers, paint thinner).

Lesson 3: Can plants clean pollutants from water?

All plants, even plants that live in the desert, need water to survive. Most plants obtain water by using their roots to absorb water and nutrients for growth from the ground. Plant roots act like "straws" to draw water up into their stem and leaves.

Plants that live in wetland areas have an important role in helping to clean water that has been polluted by stormwater runnoff. Water usually flows through wetland areas before being released into local creeks and rivers. Wetland plants (like cattails and grasses) soak up water with their roots, along with any dissolved pollutants. The pollutants are stored in the stems and leaves of the plants. As a result, the water that flows through wetlands is filtered and less pollution makes its way into creeks and rivers.

Handout: Hand out a picture page showing different types of wetland plants. Point out to students that some plants grow with their roots in the water.



By tasting "invisible" substances dissolved in tap water, students learn that all pollutants cannot be seen.

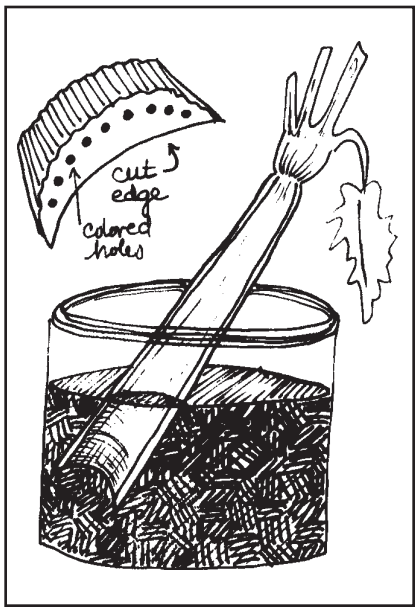
Activity 1: *Can plants suck it up?* To show how pollutants are absorbed and stored in plant stems and leave, do an experiment with a celery stalk.

Materials:

- fresh celery stalks with leaves
- water
- 1 clear glass
- knife
- red or blue food coloring

Add several drops of food coloring to water in a clear glass. Explain to the class that the food coloring represents a pollutant, such as a pesticide, that has mixed with stormwater. Ask students to name any other pollutants that the food coloring could represent.

Cut off the bottom half-inch of the celery stalks and place them in the colored water. Explain to students that the celery stalks represent wetland plants and that the colored water is the polluted stormwater that flows through wetlands. Let the celery stalks remain in the water overnight. Overnight, the colored water will travel up the the celery stalks, showing how plants can absorb pollutants with the water they "drink." The colored water may not or not be visible on the outside of the stalk.



Using celery stalks and colored water, students can see how plants "drink" water and pollutants in the water.

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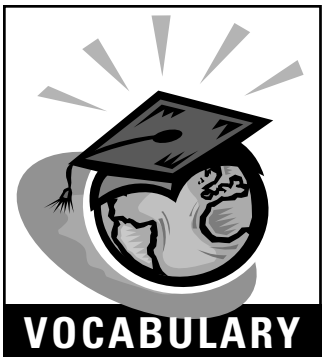


precipitation
impervious surface
storm drain
stormwater
pollution
wetland
runoff
absorb
nutrient

The next day, remove the celery stalks from the water and cut off one-inch pieces. Hand out the pieces to students and have them examine the pieces closely. On the cut surface, they will see colored dots. Explain that the dots are a cross-section of water-filled channels (like straws) that run up the celery stalk. These straws, inside the stem, soaked up the pollutants along with the water they drank. Explain that although the wetland plants can soak up pollutants too, many pollutants in the water will eventually kill the plants.

Follow-up questions:

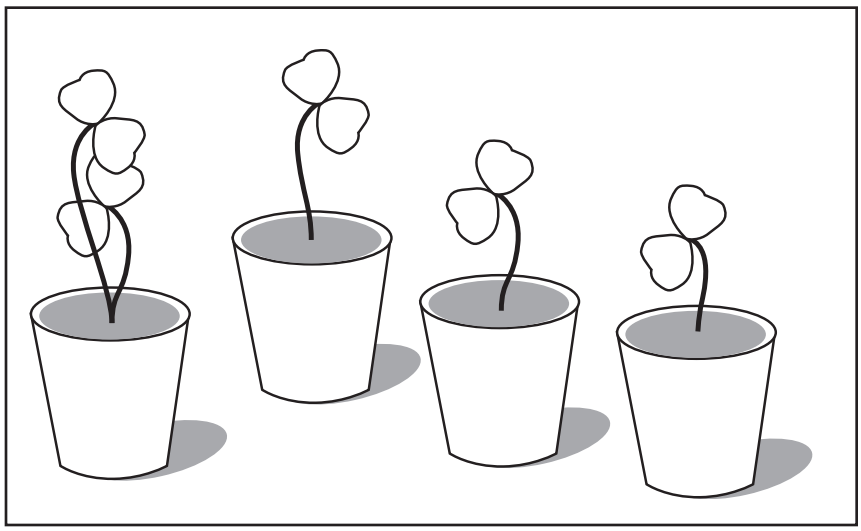
1. How do wetland plants help clean water?
2. Why is the water left in the jar still polluted?

Lesson 4: Can too many pollutants harm plants?

In Lesson 3, students saw how plants can absorb pollutants into their roots and stems. What happens when too many pollutants are absorbed into plants? Can the pollutants affect plant growth? Will certain pollutants hurt plants more than others?

Activity 1: *Do pollutants affect plant growth?* The purpose of this experiment is to see how different pollutants can affect plant growth. As students have learned, many pollutants, seen and unseen, enter the stormwater system with rainwater and are carried to local waterways. Three substances, dishwasher soap (phosphorous), bleach (chlorine), and ammonia will be used to represent "pollutants" and will be mixed with the water used on the plants. To compare the affect of watering plants with polluted water, clean tap water will be used on one plant in each group.

Safety Alert! It would probably be best if the teacher, rather than the students, watered the plants with the "pollutants."



Demonstrating the affect polluted water has on lima beans will increase students' awareness of pollution in local waterways.

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Stormwater Pollution: Learn and Share

Materials:

- small pulp pots
- lima beans
- potting soil
- bleach (chlorine) 2 tbs. mixed with one cup tap water
- dishwashing soap (phosphorous) 2 tbs. mixed with one cup tap water
- ammonia (ammonia) 2 tbs. mixed with one cup tap water
- water

Divide students into groups of four or less. Before starting the experiment, demonstrate how to plant the lima beans in the cups. Give each group eight cups and have them plant one lima bean in each cup. (Planting eight lima beans will give students a "back-up" plant if one of the lima beans fails to germinate.) Mark the cups according to which water solution will be used to water the plants. There should be two plants that will be watered with plain tap water and two plants that receive water mixed with each of the "pollutants." Mix two tablespoons of each "pollutant" with one cup of plain tap water.

After mixing the pollutants with the water, ask the students if they can see the pollutants in the water.

After planting the lima beans, ask the students what they think will happen to the beans watered with "polluted" water. Write down their hypotheses and use them later to compare with the final results of the experiment.

Place the cups on a windowsill or brightly lit shelf. Water the plants twice a week (for example, Tuesday and Friday) and measure their growth. At the end of three weeks, create a simple graph comparing the growth of each plant watered with the different pollutants. Make a separate graph of the plants watered with plain tap water. Have students compare the graphs and then ask the following questions:

1. Did any of the pollutants make the plants grow better?
2. Did any of the pollutants kill the plants?
3. What was the result of using plain tap water?
4. How do people use these substances in their everyday life and how can they get into the storm drain (e.g. soap and ammonia from washing cars)?
5. How did the students' hypotheses match the results?
6. Were there any results of the experiment the students did not expect?

SPLASH!
Stormwater Pollution: Learn and Share

4th Grade Unit: "Water Systems"

***Objective:** This unit will explore the water cycle and introduce students to Eugene's three water systems, focusing on the stormwater system. Students will compare city water systems with rural systems and how stormwater impacts rural areas. Students will also examine their personal water uses and how they affect local water resources. This unit was developed to be used as an extension of the Land and Water Science Kit.*

Lesson 1: What is the water cycle?

The water cycle refers to the constant recycling of the fresh water on our planet. There is always the same amount of water on the earth - no more and no less. Even though 70% of the earth's surface is water, only 3% is fresh water. Of that 3% of fresh water, 2% is frozen in icebergs! That leaves 1% of fresh water available for people, plants and animals use. Think about it - the water you use today is the same water that was here millions of years ago. The water you drink today may be the same water that dinosaurs played in! Because there is only a finite quantity of water on our planet, it is very important to keep water clean.

The water we have now is all of the water we will ever have. In nature, water is continuously "recycled" through evaporation, condensation and precipitation.

Evaporation: Evaporation occurs when the heat from the sun causes water on the earth's surface to turn into a water vapor. (EVAPORATE).

Condensation: Once the water vapor enters the atmosphere, it cools and forms clouds. Clouds consist of billions and billions of water droplets. This process is called condensation. When the water droplets combine, they become too heavy for the cloud to hold and fall to the earth as precipitation.

Precipitation: The water that falls back to earth from the clouds is called precipitation. Precipitation can fall in many forms. Depending on the temperature of the atmosphere or the earth's surface, it can fall as rain, snow, hail or sleet. When the ground is colder than the atmosphere, water can form fog, which is condensed moisture close to the ground. Once the water reaches the ground, the cycle starts all over again with evaporation.

Storage: Lakes, rivers, wetlands, and man-made reservoirs are places where water on the earth is stored to be available for future evaporation.

Activity 1: *The water cycle*. Give students a copy of the water cycle handout. Discuss the water cycle and have students fill in the correct words to explain the parts of the water cycle.

Activity 2: *Cloud in the bottle*. Demonstrate how water vapor condenses and clouds form by performing this experiment.

This simple experiment demonstrates how humidity, heat and air pressure influence the formation of clouds. The water in the jar (representing a body of water on earth) produces high humidity while the smoke from the match provides "nuclei" on which the water vapor can condense. As the bag is pushed into the jar, pressure and temperature increase, causing the jar to clear. When the bag is pulled out, pressure and temperature decrease, allowing water vapor to condense and produce a cloud in the jar.

Materials:

- Wide-mouth gallon pickle jar
- 1 heavy duty plastic bag
- Rubber bands
- Matches

Place about 1 cup of water in the jar. Have the plastic bag and rubber band handy. Place a lit match in the jar and immediately place the plastic bag over the jar and seal it with the rubber band. Push the bag quickly into the jar and then pull it out. Watch what happens!

After the experiment, ask the students these questions:

1. Why are smoke and water added to the jar? (the water adds humidity and the smokes provide the "nuclei" for cloud formation)
2. How does warming and cooling in the jar effect cloud formation? (warming decreases cloud formation; cooling increases cloud formation)

Activity 3: *Salt water painting*. Demonstrate evaporation by having the students do a salt water painting.

Materials:

- Salt
- Containers for paint (paper cups)
- Paint brushes
- Measuring cup
- Paper
- Warm water
- Food coloring

Divide students into groups of four or less. For each group, make salt water paint by placing 1/4 cup of salt in each container. Add 1/4 cup of warm water to each container and stir to dissolve the salt. Add food coloring to the diluted salt solution, using a different color for each group. Have students paint a picture with the salt water paint. Let the paintings dry overnight (put them near a sunny window if possible) and have the students examine them the next day. The water will have evaporated and the colored salt will remain on the paper.

To explain that all water evaporates and reforms as clouds and precipitation, use puddles in the street as an example. When the sun comes out after a late spring rain, puddles disappear quickly. Where does that water go? Remind students that water is constantly recycled and the water in the puddles evaporates and condenses into clouds. The water in the puddles still exists, but in a different form!

Ask students to write a short report explaining why the water disappeared but the salt stayed on the paper.

Lesson 2: What are Eugene's three water systems?

Most communities have several main water systems. Communities provide clean drinking water for their citizens and also clean and purify wastewater from homes and businesses. As our communities become larger and more land is used for homes and business areas, there also must be a place for water to go that falls as precipitation. In Eugene we have three water systems:

Drinking water system: Eugene gets its drinking water from the McKenzie River, which is fed by melting snow and springs from the mountains. River water is pumped to a filtration plant where it is purified. Chlorine is added to kill bacteria and inactivate viruses. The water is then put through an activated charcoal filter before it is pumped to homes, schools and businesses.

Many communities do not have rivers as a source of drinking water and use above-ground reservoirs or underground wells to provide water to citizens.

Wastewater system: The water that we use for bathing, cleaning, cooking and other things is treated at the Eugene/Springfield Wastewater Treatment Plant. Sanitary sewers carry the water to the plant where it is cleaned. It is then disinfected and is released into the Willamette River. In your house, anything that you put down the sink, toilet, or bathtub goes to the treatment plant to be cleaned.

Stormwater system: Our modified landcape now includes roads, parking lots, and buildings that have replaced natural vegetation. Any surface that prevents rainwater and snowmelt from being absorbed into the ground is called an "impervious surface." Rainwater or snowmelt that runs across these impervious surfaces is called "stormwater." As stormwater runs off these surfaces, it picks up oil, gasoline, dirt, litter, debris from construction sites, and excess fertilizers and pesticides from our homes. This runoff can also include animal waste or waste from leaky septic systems. Stormwater flows down storm drains or into open ditches that lead to local waterways. Stormwater is not treated, filtered, or cleaned. Pollutants and debris carried with stormwater damage our lakes, rivers and streams. As a result fish can die, too much algae can grow, and water can become unsafe for drinking or recreation.

Brainstorm: How is the stormwater system different from the drinking water and wastewater systems?

Brainstorm: What is an impervious surface? Can you identify places that include large impervious surfaces? (Streets, parking lots, the mall, building roofs). Is an umbrella an impervious surface?

Activity 1: *Eugene's Three Water Systems*. Hand out the "Three Water Systems" poster. Discuss the differences between the three water systems.

Extension: *Create a Landscape*. Using a flour and water paste, have students create a simple landscape with porous and impervious surfaces (use sponges for porous surfaces). Students may also add trees, and buildings purchased from a hobby

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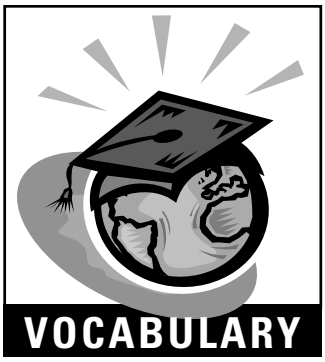

filtration plant
impervious surface
groundwater
wastewater
porous surface
septic tank
reservoir
stormwater

shop. Add "pollutants" to water and observe how the water carries the pollutants along impervious surfaces. Have students note that water and pollutants soak into porous surfaces.

Lesson 3: Personal water use

All of use water in our everyday life. The way we use water varies from person to person. Many people do not realize that their personal water use can have an impact on local water resources in good and bad ways.

Brainstorm: Have students list ways they use water every day.

Activity 1: *The Water Awareness Test*. Handout the Water Awareness Test and assign the test as homework to be done with a parent. Have students return the test and calculate scores using the score sheet on page 25. Create a *Water Awareness Graph* for the class.

Using the 15 water activities listed on the *Water Awareness Test*, discuss conservation and wasteful water use habits. Discuss how personal water use can affect local water quality and what can be done to improve personal water use habits.

Here is some information to help with the discussion of personal water use:

Do you or your family. . .

1. Leave the tap water running as you brush your teeth?

The bathroom is where the biggest savings in personal water use can be gained. Two-thirds of the water used in the average home is used in the bathroom. Running the faucet while brushing your teeth uses approximately 10 gallons of water. Instead, wet your toothbrush at the start and then rinse it once or twice through the process. This will only use about a half a gallon of water so you will save over 9 gallons of water!

2. Turn the lawn sprinkler on during the middle of the day?

By watering in the middle of the day when the sun is at peak temperature, a greater percentage of the water evaporates before it can be absorbed. Water during the cool parts of the day to keep your lawn from "burning" in the heat. To prevent lawn fungus, don't water at night. Watering in the early morning or evening is best. During dry periods, let the grass clippings stay on the lawn to help retain moisture.

3. Throw used containers of paint, solvents, or harsh cleansers in the trash?

Many products found in the home can pose a health or environmental hazard if they aren't disposed of properly. Anything labeled as toxic, flammable, corrosive, reactive, infectious, or radioactive can threaten family health and safety.

According to national estimates, each home contains from three to eight gallons of hazardous materials in kitchens, bathrooms, garages, and basements. Throwing them in the garbage can threaten sanitation workers who can be injured or poisoned by acids, fires, and explosions. Hazardous wastes that reach our landfills can leach into the soil, pollute water, and threaten all living things. Read the product label carefully to determine the best method of disposal.

4. Empty leftover paint, solvents, or cleansers into the kitchen sink or down storm drains?

Substances poured into household drains and toilets go to the sewage treatment plant where they

SPLASH! Stormwater Pollution: Learn and Share

are cleaned. However, the water is eventually discharged to the Willamette river where it can impact fish and wildlife if the toxics overload the system. The sanitary system was built to handle sanitary wastes, not hazardous wastes. Even worse, if these products are poured down storm drains, they flow directly to our waterways.

As alternative options, plan your project carefully and buy only what you need. If you do have products left over, give them to friends, neighbors, or charitable institutions to use. Allow small amounts of paint to harden in their original containers, then wrap in newspaper and dispose in the trash. It's O.K. to rinse brushes and rollers from some types of paints in an indoor sink, but never pour paints, solvents or cleansers down the drain. Check product labels carefully for disposal options.

5. Run the washing machine or dishwasher with small loads?

In the kitchen, the largest water consumer is the dishwasher — about 12 gallons per run. It's best to make sure your dishwasher is fully loaded before you turn it on, because you'll use 12 gallons whether you're washing a 10-piece dinner setting or a few cups. Shorter cycles are another way to conserve water. Scrape your dishes into the trash before loading; rinsing is not necessary for most dishwashers.

If you are the dish washer, don't run the water while doing the dishes. Fill a sink with soapy water, wash the dishes and set them on the counter. When you're done with the soapy water, drain the sink and refill it with clean water for rinsing.

6. Water your lawn frequently during the summer to achieve a lush cover?

Water only when the grass or plants show signs of needing water. If you can see your footsteps when you walk across your lawn, it's time to water. Water deeply, slowly and infrequently to develop a strong root system. Healthy lawns resist disease, require less herbicide and pesticide, and stand up to wear. In combination with rain and sprinkling, give your lawn about one inch of water per week. Water an additional half inch to one inch during dry periods.

7. Use lots of fertilizers and lawn feeder to help the lawn recover from winter?

Before you put toxic chemicals into your daily living space, consider whether they're needed. Have your soil tested to determine what, if any, amendments should be added. Plan your landscape with environmental health in mind, reducing the area that is heavily maintained. Limit the use of toxic or hazardous products. Keep the products away from storm drains, lakes, and streams.

8. Clean the driveway, sidewalk or curbside by hosing it with water?

As well as wasting water, hosing collects the surface pollutants on the driveway, sidewalk, or curbside and washes them directly into the storm drain where they flow untreated into our creeks and rivers. Use a broom to sweep up the debris and dispose of it in the trash.

9. Leave the shower running to heat up the bathroom?

Run the water only as long as it takes to get it warm and then get in quickly. Use an energy efficient showerhead to make your hot water go a long way. This not only save

water, but the cost of heating it. For example, a five-minute shower using a regular showerhead uses 30 gallons of water. That same shower using an energy efficient showerhead uses only 12.5 gallons. Energy efficient showerheads are available at many local stores. They can help save thousands of gallons of water each year!

10. Wait to repair a dripping faucet until it turns into a steady leak?

A dripping faucet can add up to gallons of wasted water every week. The repair may be as simple as replacing a worn washer or gasket. Your nearby hardware store sells repair parts for most makes and models and has staff to assist you in choosing the right part. You may also find a "how to" sheet to help the process as well. If the repairs are more extensive, consider calling a friend or a plumber.

11. Use the toilet to dispose of ordinary waste around the house?

Every time a toilet is flushed, about seven gallons of water go into the sanitary sewer system and on to the Wastewater Treatment Plant. To cut down on this waste, don't use the toilet as a trash can (for tissues, gum wrappers, cigarette butts, etc.). Reduce the amount of water per flush through two options: 1) Replace your conventional toilet with a water efficient "low flow" model which uses only 1.6 gallons of water per flush; or
2) Reduce the amount of water your conventional toilet uses by filling plastic containers with water, seal, and place in the tank of your toilet. You'll save about four gallons of water per day.

12. Wash the car every weekend in the summer?

A less frequent schedule would save gallons of water. When washing your car, use a bucket for soapy water and use the hose only for rinsing. Use a shut-off trigger sprayer to control the water flow. Running the hose in the driveway doesn't get the car any cleaner. Park the car on your lawn or gravel driveway so the ground can filter out the soap and pollutants. Don't let the soapy water run off into the street where it flows into storm drains and waterways. Consider using only water and a sponge to clean the car without soap. Or, take the car to a commercial car wash where the soapy water drains to the Wastewater Treatment Plant rather than the stormdrain system.

13. Change your oil in the street or use storm drains to dispose of used oil?

When you dump oil (or anything else) into the storm drains, it goes directly into creeks and wetlands, and eventually ends up in the Willamette River or Fern Ridge Reservoir. If you change your oil at home, use a tarp under your work surface to catch drips and spills. Collect the oil and drain the oil filter into a sealable, non-breakable container that is clearly marked and set it out for pickup by your waste hauler. Check with your waste hauler for more information about quantity, limits and pick-up frequency.

14. Sweep lawn trimmings into the curb or down storm drains or toss into creeks or ditches?

When you sweep lawn trimmings into the storm drain, surface pollutants or chemicals are swept along with them. All of these pol-

lutants are carried with stormwater directly into our local waterways where they harm fish and wildlife. When dumped into creeks, lawn debris (perhaps with fertilizers and pesticides still attached) begin to decompose. The decomposition process requires oxygen — robbing it from the creek where fish and plants need oxygen to breathe. Left in a ditch, the trimmings clog the water flow and could cause flooding. Avoid these problems by collecting the lawn clippings for your compost pile or allowing the fine clippings to remain on the lawn to retain moisture and reduce watering costs.

15. Use a garbage disposal to get rid of food scraps?

While grinding up small amounts of food waste is the purpose of a garbage disposal, avoid using it as a trash can. The amount of water required to flush the materials adds up quickly. Scrape dishes into the trash rather than down the drain and save leftovers to make your grocery dollars go further. You may also want to set up a simple compost pile using food scraps. To learn more about home composting, call the City of Eugene's Solid Waste and Recycling Program at 682-6830.

Activity 2: *Storm drain stenciling.* Introduce students to the City of Eugene storm drain stenciling program. Show the storm drain stenciling video or have staff from the Eugene Stream Team discuss the stenciling program.

Activity 3: *Design a storm drain stencil.* Have students design their own storm drain stencil with the message "Dump no Waste-Drains to Stream."

Lesson 4: City and Rural Water Systems

As we learned in Lesson 2, there are three water systems in the City of Eugene. Drinking water is treated to make it safe and wastewater is treated so it becomes safe to put back into the Willamette River. Only stormwater is not treated. Are there three water systems in the rural areas outside the city? How do people in rural areas get drinking water? How is household waste treated? Are there storm drains?

When we look at a rural landscape and compare it to a city landscape, the differences are obvious. Rural landscapes consist of open fields, farmland, and forests. People who live in rural areas are more spread out on larger properties than city inhabitants. There are fewer houses and streets, no office buildings, shopping malls or huge parking lots. Since there are fewer impervious surfaces and no storm drains to carry stormwater away, most stormwater soaks into the ground. However, stormwater runoff is still a problem in rural areas.

Many rural residents have farms and grow crops or raise livestock. Most people in rural areas get their drinking water from underground wells that are drilled on their property. Unlike city drinking water, water from underground wells does not go through a purification process at a filtration plant. Because the water is not treated before it goes into the home, the location of the well is very important. If the well is placed too close to livestock pens, it can become contaminated with animal waste that seeps into the ground when it rains. The well should also not be too close to farm fields where fertilizers and pesticides are applied to crops. These

pollutants are also carried into the ground with the rainwater and can contaminate wells. When pollutants are carried into the soil with rainfall it is considered groundwater pollution. To make sure the water is safe to drink, it is a good idea to have the water tested on a regular basis.

Since farms are not hooked up to the public sewer systems, where does the wastewater go? Wastewater goes from the house into a septic tank. Most of the liquids from septic tanks leach from the tank to the ground. The solids must be pumped out when the tank becomes too full. Septic tanks can also contribute to groundwater pollution. It is important to make sure the septic tank is not close to the drinking water well, a pond or creek because the liquids from the tank could pollute surrounding water sources.

What happens to stormwater in places where there are no storm drains? Since there are fewer impervious surfaces in rural areas, most stormwater soaks into the ground. However, some stormwater runs off roads, fields, and livestock pens into ditches that lead to nearby creeks, ponds and rivers. What happens when water from a big rain storm flows through a livestock pen and into a nearby creek or heavy rains fall on field that has just been fertilized?

Brainstorm: How are city and rural water systems different? Do they have some of the same problems? What can be done in rural areas to prevent stormwater pollution?

Activity 1: *Play "The Living Landscape" or "Desdemona's Splash" computer games.* After playing the game, compare rural and city water systems. Discuss how city and rural water systems are different. Do they have some of the same problems? What can be done in rural areas to prevent stormwater pollution?

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Stormwater Pollution: Learn and Share

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Water Awareness Test Scoresheet

Name: _____

Find your total score below and see how aware you are about water use and water quality. Check to see if there's more you could do.

20 or less

Way to go! You know a lot about the value of Eugene's water, how to conserve it, and prevent pollution.

What else can you do?

Keep up the good work! Educate your friends and family to follow your example. Join Eugene's stormwater volunteer program, the "Stream Team" by calling 682-4850.

21 to 35

Not bad, but you can do better. You know how to conserve water and to protect our surface and groundwater from pollution, but you need to make it a habit. Remember, even small leaks result in huge losses, and a little bit of pollution can hurt a lot of water.

What else can you do?

Give your friends and family this water use survey. Whenever you find problems, put your new information to work.

36 to 45

Listen up – things need to change! Like too many others, you could be hurting Eugene's water supply and even causing water pollution. You need to learn about and practice measures to save and protect water. Join a local group committed to natural resource protection.

What else can you do?

Call local organizations or government agencies for more information. Learn about and practice measures to save and protect water. Join a local group committed to natural resource protection.

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Water Awareness Graph

Name: _____

TOTALS

100															
95															
90															
85															
80															
75															
70															
65															
60															
55															
50															
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0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

WATER AWARENESS QUESTIONS

5th Grade Unit "Ecosystems and Wetlands"

Objective: *To introduce students to the concept of ecosystems and wetlands as a type of ecosystem. This unit was developed to be used as an extension of the Ecosystems Science Kit.*

Lesson 1: What is an ecosystem?

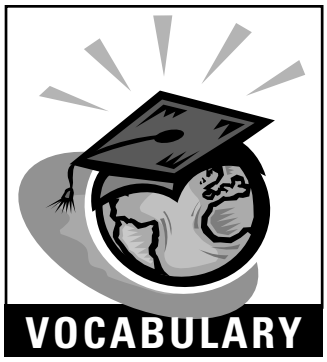
By definition, an ecosystem is an ecological community (living) and its environment (non-living) interacting and functioning together as a unit. A good example of an ecosystem is a pond. All of the organisms interact in some way and the health of the ecosystem depends on the parts themselves being healthy. Using a pond as an ecosystem can help demonstrate this concept. For example, the fish in the pond depend on clean water in order to survive. If the water (one part of the ecosystem) becomes polluted, the fish cannot survive. A breakdown in the ecosystem can set off a chain of events. If the fish die, what happens to the great blue heron that depends on the fish to survive?

Ecosystems contain three categories of life: producers, consumers and decomposers. They represent the basic food cycle. For example, algae and green plants are producers. Animals that eat algae and green plants are consumers. When a consumer dies, some bacteria, which are decomposers, break it down into organic material that enriches the soil that feeds the producers.

Ecosystems can also be man-made. For example, using a bottle, soil, a plant and water, anyone can make a terrarium. All of the parts of the ecosystem interact. The plant depends on sunlight and water to grow. Composting leaves from the plant form an organic layer that revitalizes the soil and helps it retain water. Water from the soil is recycled by the plant through the process of transpiration. As long as every part in the ecosystem remains healthy and in balance, the entire ecosystem will thrive.

Brainstorm: Are members of an ecosystem independent, dependent or interdependent of each other?

Handout: Hand out pictures of complete ecosystems. Discuss how the parts of the ecosystem interact with each other. Explain how an organism can be either a producer, consumer or decomposer. Show examples of non-ecosystems (e.g. one animal or plant) and discuss why that individual organism does not make up an ecosystem.



ecosystem
food cycle
decomposer
hydrologic regime
riparian
organism
producer
hydric soils
anaerobic
dependent
consumer
hydrophytic plants
endangered

Activity 1: *Design an ecosystem.*

To demonstrate the fragility of ecosystems, students will create and destroy paper ecosystems that include living and non-living elements.

Materials:

- Light-weight poster board
- Old magazines
- Glue
- Scissors

Divide the class into groups (4-5/group). Using light-weight poster board and old magazines, have students cut out pictures and paste them on the board to form an ecosystem. Try to include a picture of water and the sun (non-living components) in each ecosystem. Have the students identify living and non-living parts of their ecosystem and ask students to explain how the parts of their ecosystem interact with each other, identifying producers, consumers and decomposers. To demonstrate how ecosystems can be damaged, have each group pass their board to the next group. Cut up the boards and have students try to piece them back together. Discuss the fragility of ecosystems and how it is hard to restore an ecosystem once it is damaged.

Brainstorm: The food chain represents the energy flow in an ecosystem or environment. Using the ecosystems they created in Activity 1, have students trace the energy flow between the non-living parts of their ecosystems and organisms that live there.

Lesson 2: What is a wetland?

A wetland is an area that has standing water, or poorly-draining, water-logged soils for all or part of the year. Wetlands are characterized by certain types of soils and are inhabited by plants and animals that have adapted to life with changing water conditions. Examples of wetlands include marshes, ponds, emergent grasslands, and bogs.

Wetlands are found all over the world. Wetlands are an important and productive ecosystem with a rich variety of plants and animals.

There are three main characteristics that define a wetland. They are:

Hydric Soils: Wetland soils usually contain clay and are saturated with water for enough time during the growing season to create an anaerobic (low oxygen) state in the soil.

Hydrophytic Plants: Hydrophytic plants are plants that have adapted to and thrive in wet conditions and in soil with an anaerobic (low oxygen) content. Many of these plants have special stem and root systems that help them succeed in this environment. For example, reeds have long stems to help transport oxygen from the soil. Some trees form large, buttressed trunks that look like elephant legs to help support them in their wet habitats. There are even ferns that float in ponds (Azolla)!

A Hydrologic Regime: In simpler terms, the hydrologic regime refers to the presence of water above or just below the ground's surface. A wetland may be just damp, or intermittently flooded. It is the presence of water that leads to the development of hydric soils and the presence of hydrophytic plants.

Activity 1: *Play the wetland name search.* Using the list of wetland names below, have students re-

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search and identify what part of the United States or the world these types of wetlands are located. Write the names on the board and have students copy them into their notebooks. Have them describe the characteristeristics of each type of wetland. If they are able, have students determine which language some of the words are derived from.

Names:

slough	playa
carr	peat bog
pocosin	mire
glade	salt marsh
muskeg	moor
fen	estuary

Lesson 3: Where are wetlands located in Eugene?

What types of wetlands are found in and near Eugene?

Hand out a copy of "Eugene's Wetlands Self Guided Tours." Using the booklet, and the following information, locate and discuss the types of wetlands found in Eugene.

Activity 1: Show the *Wetland Types Slide* show (available from the City of Eugene Stormwater Management Program, 682-2739). Discuss each wetland type as the slides are shown. The accompanying handout identifies where this type of wetland is located in west Eugene.

In west Eugene, 42 wetlands have been studied. There are seven types of wetlands:

1. Marsh and shallow ponds
2. Channels
3. Forested
4. Scrub-shrub
5. Prairie grasslands
6. Riparian creeks
7. Agricultural

In some places, one type dominates a large area, but in many places, the wetland types are mixed. A prairie grassland may have patches of shrubs and young trees growing among the grasses. A pond or marsh may have willows or forested wetlands growing along the shore.

Each of the seven wetland types is described below with the number of sites indicated for each type. Some general notes on wildlife and plants typical of each type are also noted.

1. Marsh and shallow ponds *(9 sites)* Common plants in these wetlands include cattails, reed canarygrass, yellow iris, water lily, bulrush, popcorn flower, and penny royal. Some of the shallow ponds are wet in spring and dry out in summer. The marshes and ponds are used by geese, ducks, herons, swallows, rails, shorebirds, nutria, beaver, dragonflies, frogs, turtles, and snakes. Danebo Pond, Stewart Pond, and Bertelsen Slough are examples of this type of wetland.

2. Channels *(2 sites)* There are wetlands in the bottoms of waterways such as the Amazon Creek and the "A-3" Channels in west Eugene. Cattails and reed canarygrass are common plants. The plant and animal life in the channels are very similar to the marsh and pond type wetland, but the channels are more disturbed and contain pollution and litter. Nevertheless, the channels provide important connections between and among west Eugene's wetlands.

3. Forested *(7 sites)* These wetlands have trees that are higher than 20 feet. The two most common trees are black cottonwood and Oregon ash. Birds using these forested wetlands include red-tailed and sharp-shinned hawks, downy wood-

pecker, American robin, Bewick's wren, and black-capped chickadee. Beavers enter these forests to find their favorite food trees. Forested wetlands can be found along the upper end of Bertelsen Slough and at Willow Creek.

4. Scrub-Shrub *(Mixed with other sites)* These wetlands have trees and shrubs less than 20 feet tall. Common plants include young Oregon ash, black hawthorn, wild apple, willow, wild rose, and Douglas' spiraea. These wetlands border ponds and drainageways; are mixed among forested wetlands; and are scattered among the native prairies. This type of wetland is often mixed with other wetland types and does not dominate any west Eugene site. Sparrows, wrens, finches, and rufous-sided towhees use these wetlands for food and cover. Scrub-shrub wetlands can be found at Willow Creek and at the old Danebo drag strip site on Danebo Avenue (the Balboa site).

5. Prairie grasslands *(13 sites)* This is one of the most important wetland types in west Eugene. Common plants include tufted hairgrass, (*Deschampsia cespitosa*), reed canarygrass, rushes, sedges, and forbs such as smartweed, sloughgrass, mint, and gumweed. In spring, common camas provides a showy blue flower in these wet, native prairie grasslands. Green-winged teal, mallard, and American wigeon are ducks that feed on plants and seeds in these fields. Mice and shrews live in these grassy areas and provide food for the short-eared owl, northern harrier (marsh hawk), and American kestrel (a small falcon). Common snipe and western meadowlarks frequent the grassy wetlands. Gophers and garter snakes also hunt in these areas looking for rodents. Red fox can be found hunting for mice in the open prairies.

Prairies once covered about 750,000 acres in the southern Willamette Valley with an estimated 300,000 acres of wet, native prairie grasslands. Infrequent natural fires and fires set intentionally by the Kalapuya Indians kept the forests and scrub-shrub woody plants from encroaching on the prairies. The Kalapuyas used fire to make it easier to hunt and to harvest bulbs, seeds and berries. Camas bulbs were used as a major part of their diet. Today, many of the prairie grasslands have been drained and converted to agricultural use. In the past few years, naturalists have been experimenting with fire at Willow Creek and throughout the west Eugene wetlands as a tool to maintain the prairies by controlling the woody plants that encroach on the grasslands.

There is less than one-tenth of one percent of the original prairie grassland wetland type left in the Willamette Valley. Most of them are concentrated in Benton and Lane Counties. In the Eugene vicinity, there are several grassland sites in west Eugene, some near Fern Ridge Reservoir, and a few in Camas Swale south of Eugene along Interstate-5. These prairies can also be found at Willow Creek, along West 11th Avenue between Belt Line Road and Greenhill Road, and along Highway 126 between Fisher Road and Coyote Creek. This wetland type provides habitat for three rare plants: Bradshaw's desert-parsley, a federally listed endangered plant; the Willamette daisy, also a federally listed endangered plant; and Aster curtis, a white-topped aster, a plant considered for listing. Tufted hair-

grass (*Deschampsia cespitosa*) is the dominant plant in the wet prairie plant community. Tufted hairgrass forms raised mounds (hummocks) and reaches heights of 3-6' in west Eugene.

6. Riparian creeks *(1 site)* This wetland type is found only along Willow Creek. Riparian means streamside, and this type is found along the creek channel. Most natural creeks in west Eugene have been channelized (for example, Amazon Creek). Black cottonwood, Oregon ash and willows are common trees along Willow Creek with Oregon white oak growing in drier places. There are beaver dams along the creek, and the forests provide cover for black-tailed deer. Important songbirds found in these riparian areas are willow flycatcher and yellow-breasted chat. Western screech-owl, downy woodpecker, northern flicker, purple finch, mourning dove, and black-capped chickadee live in the wet forests, as do pacific tree frogs. Many riparian areas are former creek channels that were cut off when the creeks were channelized. They are still an important habitat for many species.

7. Agricultural *(10 sites)* Most of these disturbed wetland sites are planted in grass seed crops. Many kinds of waterfowl and shorebirds use these wet fields for feeding and resting in winter and early spring. This is a time when tender grass shoots are an important food for waterfowl, especially Canada geese. Although these fields do not support native wetland plants, many have pockets of standing water and wetland soils that are saturated through spring. Most agricultural fields would be much wetter if not for drain tiles and ditches. If farming ceased and drainage was stopped, many of these fields could be restored to true, functioning wetland status. Many of these same fields were native prairie grasslands 100 years ago.

Activity 1: *Take a tour of the west Eugene Wetlands*. Have students keep a journal of what they saw, what they heard, what they touched, and what they smelled. Also have students note in their journals what type of wetlands they observed (forested, scrub-shrub, prairie grassland). Call Eugene Stream Team at 682-4850 to schedule a tour.

Activity 2: *Write a story or poem*. Following the wetland tour, have students write a story or poem about their experience in the wetlands. They may use the information they wrote in their journals.

Lesson 4: Why are wetlands important?

Many wetlands in the United States and the world have been filled, drained, or polluted. Why should we care about the wetlands that are left? Because wetlands have many important values—second only to tropical rain forests, wetlands are some of the most productive environments on the earth's surface. Among the things wetlands provide are:

1. Home for plants. Many kinds of plants, including many rare plants, live in wetlands. In one study in west Eugene, 144 species of plants were identified, and 52 of them lived in wetlands most of the time. At the Willow Creek Natural Area in southwest Eugene, over 200 kinds of plants have been found, including three kinds of rare plants.

2. Home for animals. Many kinds of animals live in wetlands including birds, mammals, fish, reptiles, amphibians, shellfish, insects, spiders, and other small animals. These animals live on plants, under the ground, and in water. In west Eugene, the rare Fender's Blue butterfly (federally listed as endangered) lives near Willow Creek.

3. Flood control. Because of their capacity to hold water, wetlands act like sponges and store water from winter storms. Wetlands also help control floods. When wetlands are destroyed, floods can be much worse. Some wetlands, like the Amazon Creek, are part of the City of Eugene's Public Works storm drainage system.

4. Clean water. Wetland plants slow down water flowing in streams; slowing the water allows small bits of dirt in muddy water to be trapped by plants and to settle to the stream bottom. This cleans the muddy water. Wetland plants also soak up pollutants along with water and nutrients. Wetland plants can actually use some of the pollutants in dirty water to help them grow without being harmed. However, those same chemicals can hurt fish, so the plants help clean the water for other living things. For example, cattails use a chemical called phosphorus which is common in soaps that we use to wash dishes, clothes, and cars. Too much phosphorus is harmful to many animals that live in streams, ponds, and lakes.

5. Cool water. Wetland plants shade the water and help keep the water cool in the summer. When the water gets too warm, oxygen in the water is reduced, and many animals that live in the water, like fish, cannot get enough of the oxygen they need to live.

6. Groundwater recharge. This is a fancy term that means that wetlands trap water above the ground's surface (like a sponge) and then slowly let that water seep down into the soil to replenish the water supplies underground.

7. Protect soil. Wetland plants and their roots hold soil in place and keep dirt from being washed away by fast-moving water during floods and storms.

8. Recreation. People enjoy playing in and near wetlands to fish, canoe, boat, swim, bird watch, hunt, study plants and animals, take photographs, paint, bicycle, hike, and jog along trails near wetlands.

9. Open space. Wetlands are sometimes so wet that they are too expensive to build on or develop. So, they remain as natural, green spaces in cities or on farms. These natural areas are especially important because they are some of the last "wild" areas left in cities. They are valuable to people for a pleasant walk, a place to read a book, sit and think, listen to bird and insect sounds, watch the bees and butterflies, or just enjoy the rain or sunshine away from busy city life.

10. Economic development. Wetlands are a tourist attraction. Also, people will often pay more to have a home or business located near a wetland so they can see birds and green, open spaces from their windows, decks, and yards. By protecting water quality, keeping soil from eroding, and controlling floods, wetlands have economic value.

Much of the debate over wetlands in the United States is about how easy it should be to develop (fill or drain) a wetland. How do you define wetlands and how do you tell where they start and stop? For example, how do you tell a wet prairie from

an upland prairie? If a wetland is wet only part of the year, how do we tell if it is a wetland? How important is such a wetland compared to a marsh that has water in it all year long? How much protection should be given to wetlands when city development (homes, businesses and roads) or farming development (growing crops or grazing animals) is needed on private land? These are difficult questions to answer when wetland values are compared to other values. During the past few years, there have been many arguments about these questions, and many laws have been discussed to try to settle these disagreements.

Activity 1: *Solve the problem of urban growth and protecting wetlands.*

How can our cities continue to grow without destroying wetlands?

Have the students work in groups to come up with a solution to this situation that would benefit the community while preserving wetlands. Have each student write a report based on their group's solution.

Lesson 5: How does stormwater pollution affect local wetlands?

Many of the small creeks and streams that flow through Eugene eventually reach the west Eugene wetlands. The most obvious example is Amazon Creek. Fed by many smaller creeks originating in south Eugene, Amazon Creek flows through the city, through the west Eugene wetlands and finally into Fern Ridge Reservoir. Amazon Creek also serves as a stormwater drainage channel in Eugene. So, any pollutants that are carried into the stormdrains near the creek will flow with the creek all the way to Fern Ridge Reservoir, down the Long Tom River and into the Willamette River. Polluted stormwater can also be deposited in wetlands areas directly from nearby sources.

Stormwater pollution can affect wetlands in many ways. Oil, gasoline and other deposits from automobiles can kill fish and invertebrates living in ponds and streams. Excess fertilizer from our yards can cause "algae blooms" in creeks and ponds. This excessive growth of algae uses up valuable oxygen, making less available for fish and aquatic organisms to breathe. Pet wastes pollute water with bacteria that can make water unsafe to drink or swim in. Phosphorus from soaps and detergents can also harm aquatic life. Dirt and debris from construction sites can clog waterways and make the water too muddy for fish to breathe. Birds and animals that feed on fish, aquatic organisms and plants are also harmed by stormwater pollutants. As in any other ecosystem, the destruction of one part can lead to a chain of events that can doom the entire ecosystem.

Is there anything other than rainwater that should go down a storm drain? NO! If you won't eat it or drink it, don't put it down a storm drain!

Brainstorm: Have the students corrolate what happened to their aquarium when pollutants were introduced to could happen in a larger environment like a wetland area in west Eugene.

Activity 2: *Wetland Metaphors.*

Use this fun exercise to test student's comprehension about wetlands and their function.

Define "metaphor" and use the list below as examples of wetland metaphors. After reviewing the list, have students work in groups or pairs to brainstorm more wetland metaphors. It may help to make copies of Lessons 3 and 4 for students to use as a reference. Have each group share their metaphors with the rest of the class and ask the class to provide explanations for each metaphor.

Sample metaphors:

Metaphor

A wetland is a sponge.

Explanation

Wetlands soak up water and prevent flooding.

Metaphor

A wetland is a pillow.

Explanation

It's a resting place for migrating birds and salmon.

Metaphor

A wetland is an egg beater.

Explanation

In some wetlands, salt water and fresh water get "mixed."

Metaphor

A wetland is a cradle.

Explanation

Many plants and animals use wetlands for nurseries.

Metaphor

A wetland is a strainer .

Explanation

Plants filter out sediments and pollution.

Metaphor

A wetland is a can of soup.

Explanation

Wetlands provide food for wildlife and humans.

Metaphor

A wetland is a boat.

Explanation

Wetlands provide recreational opportunities.

Metaphor

A wetland is a book.

Explanation

People can learn a lot from wetlands.

Note: Be clear in your use of metaphors. Be careful not to confuse metaphors with similes. Similes use the word *like*, i.e. "A wetland is like a sponge because it stores water."

6th Grade Unit "Stormwater Runoff"

Objective: In this unit, students will calculate the volume of stormwater that runs off their school grounds. They will also collect, categorize and analyze debris and pollutants from impervious surfaces that are carried with the stormwater into local waterways.

Lesson 1: Calculate Stormwater Runoff

To help students understand the concept of runoff and its impact on local waterways, they will use their own school as a test site to calculate stormwater runoff. The purpose of this activity is to have the students use annual rainfall statistics and their school's impervious surface area to determine the volume of stormwater that drains from the school grounds, untreated, directly into local waterways.

Background

The City has collected stormwater user fees as part of its sewer user charge since the 1960s. The fees help the City operate and maintain the stormwater system which includes publicly maintained pipes, culverts, gutters, catch basins, ditches, channels, ponds and wetlands.

The basis of the stormwater fee has changed from "water meter size" to "impervious surface." Impervious (or hard) surfaces are areas such as rooftops, driveways, parking lots and patios. The more impervious surface a property has, the greater the amount of stormwater runoff. Any pollutant the runoff collects as it flows over these surfaces is ultimately carried into local rivers, streams and wetlands. The greater the runoff, the greater the impact on the stormwater system.

Definitions:

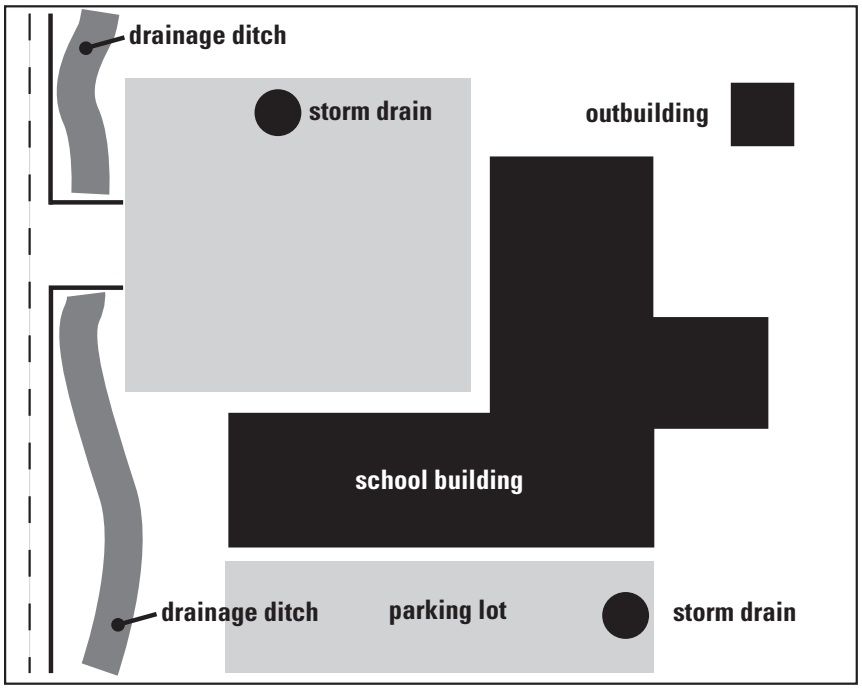
Stormwater system - includes publicly maintained pipes, culverts, gutters, catch basins, ditches, channels, ponds, wetlands and their related waterways.

Impervious Surface - hard (non-porous) surfaces such as rooftops, driveways, sidewalks and patios. These surfaces do not absorb and filter water as vegetation and soil does. Water and any pollutants it carries flows across these surfaces ("runoff") into local waterways and wetlands.

Gallon - 1 equal to a volume of 231 cubic inches in English system measurement.

1 equal to a volume of 3.785 liters in metric system measurement.

Sample Site Map



Nonpoint Source Pollution - includes materials and chemicals which are washed into the stormdrain system from a variety of sources. These pollutants are washed by rainwater and other means from streets, neighborhoods, farmlands, construction sites and parking lots. Because storm drains are separate from household sewer systems, these polluted waters flow directly into our creeks and rivers without treatment. The Environmental Protection Agency calls nonpoint source pollution the greatest remaining threat to America's fresh water supplies.

Point Source Pollution - Pollutants that come from a single point source such as the end of a pipe, factories or sewage treatment plants. The source is easily identifiable.

Materials:

- Class set of school grounds map (available from school custodian or main office)
- Tape measures or yardsticks
- Annual rainfall statistics available from the National Weather Service, 5241 NE 122nd Avenue, Portland, Oregon 97230. Phone (503) 688-9041 or get the statistics from their website at www.nws.noaa.gov. Rainfall statistics for Lane County are also available at this website: http:geography.uoregon.edu/infographics/lcweb/lcindex.htm
- *Calculate Impervious Surface Runoff* worksheet

Note: If a school ground map is not available, assign a team of students to measure schools building and parking lots. Have them create a simple site map similar to the sample on this page.

Procedure

Divide the class into teams of two or three students.

Use the school grounds map and assign areas to be measured by each team.

Option: Have class examine the map and come to agreement about who will measure what areas.

As a class, determine the kind of measurements the students will need to take. **Note:** Decide whether the metric or English system will be used.

Distribute copies of the school grounds map and have students use their copies to plan what and how they are going to measure before they go out to do it.

Send students out to measure. Each team records measurements for their section on their copy of the school grounds map. **Note:** Since students will be spread out all over

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the school grounds, advise your colleagues in advance of the procedure. Parent volunteers would also be a big help at this stage.

Have students note the location of storm drains or open ditches on the school grounds and mark them on their site maps.

When students return with measurements, distribute the *Calculate Impervious Surface Runoff* worksheet.

Direct students to calculate the area of their team's section of the school's impervious surface. (See "Math Calculations")

Record each group's calculation on the board or an overhead (made from *Calculate Impervious Surface Runoff* worksheet) while students copy onto their individual copies.

Math Calculations

Add all the areas together. Multiply the total area times the average yearly rainfall. Divide the result by the cubic volume of either a gallon or a liter. The result is the number of gallons or liters of total rainfall that fall onto the school's impervious surfaces. This rainfall gathers surface pollutants and drains directly into local streams and rivers and is not absorbed and filtered by natural vegetation and soil.

Discussion

Use a gallon or liter container to help the students visualize how much water runs off into the stormwater system.

Through questions and discussion, help them understand what happened to that runoff before the school was built and what happens to it now.

Questions

1. Where does the runoff from the school's impervious surfaces go?
2. Is the runoff cleaned up or treated in any way?
3. Before the school was built, where did the water go?
4. What would happen if we let all the runoff from the school's impervious surfaces just run onto the ground around the building?
5. If you were designing a school building, how would you deal with the impervious surface runoff? Why?
6. What effect does the impervious surface runoff water have on the stormwater system and the ecosystem/environment of the school grounds?

Lesson 2: Determine Pollutants in Local Waters

Once the students determine the volume of water that runs off their school's impervious surfaces into the stormwater system from Lesson 1, they can now determine what pollutants that water carries into local waterways.

Student teams will take debris samples from different locations on their school's impervious surfaces. These samples will be analyzed and categorized to estimate the total amount of debris/pollutants that are washed into local waterways.

Note: The week before starting this lesson, have students bring containers (preferably plastic and recyclable) from home to be used for collecting and sorting debris.

Materials for Each Student Team

- Map of school grounds (reuse from Lesson 1)
- Meter or yard stick and masking tape
- Whisk broom, dust pan and bucket
- Plastic gloves and pollen masks
- Tongs, sifters
- Containers into which collected debris can be sorted and categorized such as plastic food containers, baby food jars or even milk cartons.
- Labels
- Scale for measuring debris/ pollutants
- Copy of *Pollutants* worksheet for each student.
- *Calculate Impervious Surface Runoff* worksheet used in Lesson 1.

Divide students into teams of two or three students. Teams formed for Lesson 1 may be used.

Prepare

Assign sample plots or have the class examine the school grounds map and come to agreement about who will sample what areas. If the same groups are used as in Lesson 1, students may like to gather the samples for this activity from the same area they measured in Lesson 1.

Using the meter or yard sticks, the student teams measure and mark off one square yard of the impervious surface in their assigned area using masking tape.

Collect

Wearing gloves and pollen masks, students sweep up and collect the debris and dirt within their marked area. Place the debris in a bucket marked with student names, date and location.

Note: Parent volunteers could be helpful at this stage.

After the collection is complete, have the students remove the masking tape so that it won't be worn away and eventually enter the stormdrain system.

Sort

Students take the debris back to class and use sifters and tongs to sort the debris into containers according to type. Labels are included to identify the debris in the containers.

Weigh

Using the scales, each team weighs the debris in each category and records the weight next to their group number or name on *Pollutants* worksheet.

Report

Using the blackboard or overhead (made from *Pollutants* worksheet) have the students report their categories and weights. As each group reports, record the data onto the blackboard or overhead transparency as students copy it onto their own copies of *Pollutants* worksheet.

Calculate

Continuing with *Pollutants* worksheet, lead the class in calculating the average per yard weight of each type of debris by averaging all the groups' weights in each category.

Have the class estimate the total weight of each debris category by multiplying the averages by the total area they calculated in Lesson 1. Use the *Pollutants* worksheet (from Lesson 1) as a reference.

Discussion

1. Are the estimates of the total weights of each debris type realistic? Why/Why not?
2. Where does the debris go when it rains? Is it washed off the impervious surface?
3. Is this debris/pollutant treated or filtered in any way?
4. What effects might each of the debris/pollutant types have on the environment?
5. What alternatives are there?
6. What could be done at school to decrease the negative effects of this runoff?

Note: A large portion of a school's impervious surface area is its roof. Because roofs are not safe places for students, they should not be included in the area from which samples of debris/pollutants are collected.

School custodians and district maintenance crews may periodically clean the school's impervious surfaces. Have students undertake this activity before such a cleaning, if planned.

Extension

The debris/pollutants gathered from one sample plot could be emptied into a glass tank with the amount of rain that would fall on that plot in a year added to the tank. Students can see what the runoff entering the stormwater system might actually look like.

Have students calculate the monthly stormwater fee for their school building. Use the *Stormwater Program User Fees* fact sheet, available from the City of Eugene, to determine the category and appropriate fee schedule.

Calculate Stormwater Runoff Worksheet

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Group: _____

Date: _____

Name: _____

Name: _____

Name: _____

Student Group	Area Description	Dimensions	Area

TOTAL AREA **= (A)**

(A) _____ **X** **(B)** _____ **=** **(C)** _____

Total area of school's impervious surface

Annual Rainfall

(C) _____ ÷ **(D)** _____ **=** **(X)** _____

(AxB)

Cubic volume of gallon (231 inches) or liter (3.785 liters)

Number of gallons or liters of rainfall that fall on the school's impervious surface and runs off into local streams and rivers.

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Determine Pollutants in Local Waters **Worksheet**

Name: _____

Date: _____

Weight by Category

Student Team	Rock	Sand	Dirt	Glass	Paper	Plastic	Plant	Food	Fabric	Metal	Wood	Other	Unknown

Math Calculations: Determine the average weight for each category by adding all the weights for that category and dividing by the number of student teams.
Example: The added weight for the "Sand" category by Groups 1-6 = 10 pounds. Divide 10 pounds by 6 groups = 1.67 pounds. The average amount of calculated sand was 1.67 pounds per team.

Calculation #1: Determine Average Weight of Each Debris Category.
Toal Weight of Each Debris Category _____ x # of Student Groups _____ =
Average Weight of Each Debris Per Square Yard/Meter _____ .

Calculation #2: Determine Total Debris Washed into Stormwater System from School Grounds
Average Weight _____ x Total # of Square yards/meters _____ =Total Debris _____.

7th Grade Unit "Impervious Surfaces and Pollutants in Local Waterways"

Objective: In this unit, students will measure and calculate the amount of impervious surface at their own homes. Using the data they have collected, they will calculate the average percentage of impervious surfaces in residential areas. Students will also inventory materials and substances that might be used at home and will determine how these substances could impact local water quality. Students will also record activities that effect stormwater runoff and develop strategies to change practices that negatively affect stormwater quality.

Lesson 1: Calculate Impervious Surface Area at Home

In this lesson, students will measure and calculate the amount of impervious surface at their own homes. Once the individual data is gathered, they will calculate the average percentage of impervious surfaces in residential areas. While students are gathering and calculating data, they can also keep a journal (**see Lesson 3**) of what they observe taking place on the impervious surfaces at home and in their neighborhood.

Materials

- Measuring tape (may have one at home they could use)
- *Calculate Impervious Surfaces at Home* Worksheet

Preparation

To prepare students for this activity, have them visualize their home lots or acreage.

Discuss with students what kind of structures or ground coverings are considered impervious surfaces. You may want to write a short list on the board for students to copy and take home: roofs, driveways, sidewalks, patios, buildings, etc.

Have students mark their rough sketches where they will need to take measurements.

Using these rough drafts, students go home and record actual measurements using tape measures.

Note: Students who live in rural areas on larger tracts of land may find measuring the dimensions of their property difficult. Have them ask their parents for the dimensions of their property. The response will probably be in acres. Have them convert the acreage into square feet: One acre=43,560 square feet or 4,047 square meters.

Sketch

Have students make a rough sketch on scratch paper of the shape of their property and the size and location of any buildings.

Scale Drawing

When students return to class with their rough drafts and measurements, distribute copies of graph paper to each student.

Using the graph paper, have students construct a scale drawing of their property, structures and other impervious surfaces using the measurements from their rough drafts. Students who live on property larger than one quarter to one half an acre will probably not need to include the whole property unless it is largely covered by structures or impervious surfaces.

Calculate

Make copies and distribute the *Calculate Impervious Surfaces at Home* worksheet to each student. Have the students calculate the square footage area of the structures and impervious surfaces (questions 1 and 2). It would be helpful to show them how to divide the areas into shapes that can be easily calculated. It is not necessary to be exact (questions 3 and 4).

Use the total square footage of impervious surfaces and divide it by the total property area (question 5). The result is the percentage of property that is covered with impervious surface.

Have the students average their individual impervious surface percentages together to calculate the average percentage of impervious surfaces for their neighborhood. Record on the worksheet (question 6).

Option: Divide the data into urban and rural properties and determine these average percentages separately (questions 7 and 8). Or, divide the data by property sizes.

Discuss

1. What effect does this amount of impervious surface and its subsequent untreated stormwater runoff have on local waterways?
2. How do human activities on these surfaces affect the quality of stormwater runoff? What effect can pets and livestock have on stormwater runoff?
3. What is the difference between the water quality of runoff in urban areas compared with rural areas?

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Calculate Impervious Surfaces at Home **Worksheet**

Name: _____

Date: _____

1. Calculate the square footage area of the structures on your property:

2. Calculate the square footage area of other impervious surfaces on your property:

3. Determine the total surface area of your property covered with impervious surfaces:

4. What is your home's total property area in feet?

5. Determine the percent of your property that is covered with impervious surfaces:

6. What is the class average of individual impervious surface?

Optional:

7. What percent of this is urban?

8. What percent of this is rural?

Lesson 2: Effects of Stormwater Pollutants on Local Water Quality

In this lesson, students will inventory materials and substances that might be used on impervious surfaces in their homes. Materials could include cleaning solutions, paint, fertilizers and pesticides. This information will then be used to determine the effect these substances have on the stormwater surface runoff and the waterways into which the runoff discharges.

Materials

- *Household Hazardous Waste Inventory* Worksheet
- *Household Hazardous Waste Wheel*

Procedure

Copy and distribute *Household Hazardous Waste Inventory* Worksheet to each student.

Discuss the process to have the students take their worksheets home and look in their garage, basement, workshop, closet, etc., for substances listed on the worksheet. They may want to check with their parents to be sure they don't overlook anything. Add any substances their family may use on impervious surfaces that do not appear on the list. Make sure they note the type and amount of each substance and where and how it is used.

Research

When students return with their completed worksheets, distribute the *Household Hazardous Waste Wheel*. The wheel provides information on the proper method of disposal for each substance as well as suggesting alternatives. Using their completed home inventories on the *Household Hazardous Waste Inventory* Worksheet in conjunction with the *Household Hazardous Waste Wheels*, have students research water quality effects of pollutants their family uses. Resources include the library and the internet.

Report

Have students write a report on the source of pollutants, their effects on water quality, and possible solutions/alternatives.

Project

Have each student make a poster, labels or brochure that contains the disposal information that his or her family needs. They may decide to make drawings, clip pictures from magazines, take photographs, etc.

Extension

Have students make a report describing how their family has changed behavior as a result of this project. Suggest they use photographs, artwork, samples, etc.

Lesson 3: Journal of Local Water Quality Impacts

In this lesson, students record activities they see take place on the impervious surfaces of their neighborhood on a journal sheet. They then discuss with the class what they observed and develop strategies to change practices that negatively affect stormwater quality.

Materials

- Journal Sheet
- Butcher paper hung on wall
- *Household Hazardous Waste Wheel*

Extension

- Fact Sheet "Storm Drain Stenciling Program"
- Fact Sheet "The Environmentally Smart Car Wash"

Observe

Students spend 15-30 minutes on 4-6 different occasions walking through their neighborhood and recording activities they observe that may affect local water quality. Examples could be litter being thrown in the gutter, someone washing a car, a parked car leaking oil or antifreeze, or any activity that could result in pollutants being washed down a storm drain. Record these observations on *Observe and Record Water Quality Impacts* Worksheet

Record

When students complete the *Observe and Record Water Quality Impacts* Worksheet, have the class generate a list of all the observations on a butcher paper banner hung on the classroom wall.

Discuss

Discuss the effect that individual activities and substances may have on surface water and stormwater runoff. How do they affect water quality? Refer to the *Household Hazardous Waste Wheel.*

Have students choose 4-5 substances or activities they think have the most negative water quality impact. Have them use the criteria of frequency and/or extent of damage to make their decisions.

Lead a class discussion in alternatives to the hazardous substances or activities using the *Household Hazardous Waste Wheel* as reference.

Act

Have students design and implement an education strategy to improve the water quality impacts in their neighborhood. Some possibilities might be developing posters, flyers or newsletters. Encourage students to contact their neighborhood leaders and place an article in the neighborhood newsletter. For neighborhood leaders, contact the City Manager's Office at 682-5010.

Hold an "Environmentally Safe Car Wash" on a sunny Saturday to raise money for your school group and demonstrate how to protect Eugene's water quality at the same time. Students may write and design fact sheet to hand out to vehicles owners. See *The Environmentally Safe Carwash* fact sheet for additional information.

SPLASH!
Stormwater Pollution: Learn and Share

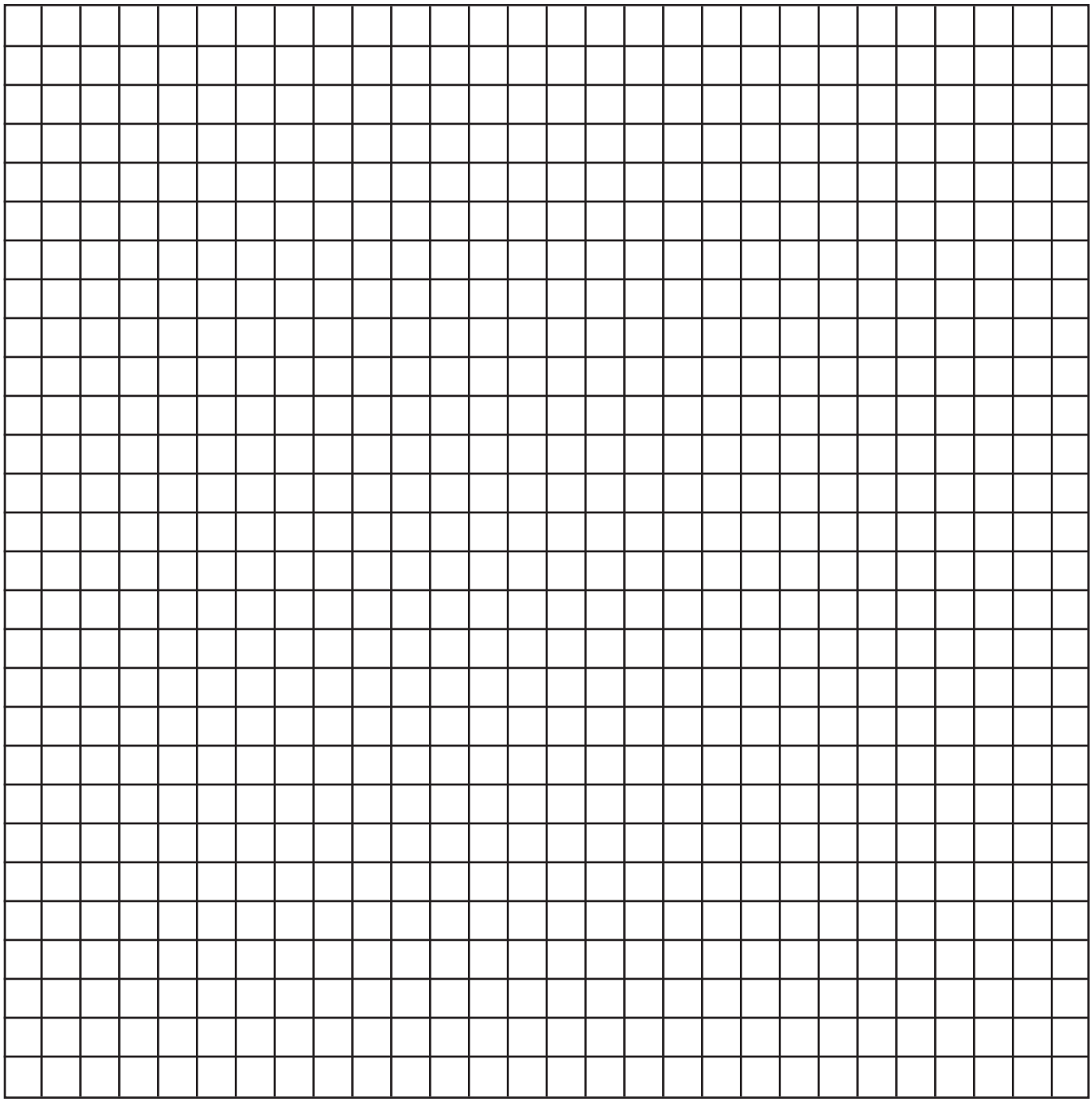
Graph Paper

Scale:

1 square= _____

Name: _____

Date: _____



SPLASH!
Stormwater Pollution: Learn and Share

Household Hazardous Waste Inventory Worksheet

Name: _____ Date: _____

Hazardous Substance	Product type/ Brand name	How much do you have?	Where/How is it used?	Where is is stored?
Antifreeze				
Transmission Fluid				
Brake Fluid				
Motor Oil				
Enamel or Oil Based Paint				
Latex/Water Based paint				
Rust Proof Coatings				
Paint Thinner or Turpentine				
Wood Preservatives				
Stain/Varnish				
Pesticide: Arsenics				
Pesticide: Botanicals				
Pesticide: Carbamates				
Pesticide: Chlorinated Hydrocarbons				
Pesticide: Roach/Ant				
Herbicides				
Pool/Spa Chemicals				

Observe and Record Water Quality Impacts Worksheet

Name: _____

Journal Sheet

Date	Time	Location	Activity	Stormwater Quality Impact

8th Grade Unit "Watersheds, Wetlands and the Willamette"

Objective: Students will study local watersheds and wetlands, including the history of the west Eugene wetlands and the native Kalapuyas. Students will also learn how pollution in local waterways can impact a broader area.

Lesson 1: Identify Eugene's Watersheds

In this lesson, students will identify Eugene's watersheds and determine into which local waterways their neighborhood runoff drains. They will also learn how pollution in local waterways can impact waterways upstream from Eugene.

Definitions

Watershed 1. A ridge between regions whose water drains into two different rivers. 2. The region or area drained by a river system or other body of water. 3. A critical point serving as a dividing line.

Topographical 1. Detailed and precise description of a place or region. 2. The technique of graphically representing the exact physical features of a place or region on a map. 3. The physical features of a place or region. 4. The surveying of the features of a region or place.

Materials

- Large, topographical Eugene map that includes local waterways.
- Student topographical map (smaller version of topographical map). Photocopy a section from Eugene West or Eugene East maps for each student.
- Overhead made from a section of the topographical map.
- Colored pencils
- Classroom Parks and Open Space map.

Orient

Post topographical map in classroom. Use your classroom science textbook to supplement how to read and use topo maps.

Distribute student copies of topographical map.

Use the overhead of the map to explain the conventions and markings of a topographical map. Relate the large classroom topographical map to the students' version.

Use the altitude lines and the

location of one waterway (not in the students' neighborhood) to demonstrate how a watershed is defined.

Define

Either individually or in teams, have the students define Eugene's watersheds using their student topographical maps. Use colored pencils to trace over each waterway in its own color and then shade in the related watershed in the same color. Students will need to pay close attention to the altitude markings to do this correctly.

Cross Reference

Direct students to locate their homes and school on their topographical watershed maps. They will need to use the Eugene street map, posted on a classroom wall, to accomplish this task.

Discussion

Lead a class discussion about the characteristics of the watersheds where the students live. Have them describe any characteristics of the waterways. How would surface water (stormwater) runoff from their neighborhood be affected by these characteristics? How might Eugene's waterways have changed because of humans?

Extension

Have students observe a neighborhood waterway and write a paper or create a visual presentation describing its characteristics. Observations and descriptions should include:

- Type of terrain and neighborhoods the waterway flows through
- Color and clarity of the water
- Relative speed of the water at different points
- Animal and plant life
- Debris, pollution and possible sources
- Human uses
- Tributaries (where does it flow from or flow to?)

Note: This may best be accomplished in student teams. Caution students to stay out of the water since there may be harmful substances in the waterways. Observations from the bank of the waterway afford a broader perspective.

Extension

Hand out copies of "Troubled Waters." Ask students to read the article and provide written answers to the questions at the end of the article. Discuss the connection between our local watershed and the pollution of the Willamette River upstream in Portland.

Lesson 2: The Importance of Eugene's Wetlands

In this lesson, students will locate wetlands familiar to them on a map of Eugene and will learn the characteristics and importance of wetlands.

Materials

- Brochure "Eugene's Wetlands" by the City of Eugene, Public Works.
- Eugene Parks and Open Space Map
- Stick pins or dot labels
- Classroom Map of Eugene's Wetlands
- Videos "Fabulous Wetlands" and "The Wealth in Wetlands" available for checkout from School District 4J's Instructional Services Division at 687-3291, or

the City of Eugene Public Works Administration, 682-2739. Refer to the *Additional Resources* section at the back of this unit for more information.

- *Values and Functions of Eugene's Local Wetlands* Worksheet
- Brochure "American Wetlands, a Reason to Celebrate"

Wetland Overview

Distribute the "Eugene's Wetlands" brochure, and discuss as an overview of local wetland sites.

Brainstorm: Wetland Sites

Refer to the Map of Eugene, posted on classroom wall. Have students brainstorm and mark areas on the map they think may be wetlands using stick pins/dot labels.

Use the *Classroom Map of Eugene's Wetlands* as a reference to have students complete the map using the correct wetland area names when known.

Videos

Show videos and have students take notes on the values of wetlands. Discuss characteristics of wetlands close to your school.

Worksheet

Either as a class, in small groups, or as individuals, have students complete the *Values and Functions of Local Wetlands* worksheet. For a complete listing of these values and functions, refer to the brochure "American Wetlands, a Reason to Celebrate."

Extension

Direct students to survey their peers, parents and other adults in the community to determine the level of public knowledge about the location, extent and values of local wetlands. Based on the results of this survey, students design and implement a public information strategy to educate citizens in those areas that the survey showed were misinformed and/or uninformed. Some possibilities include posters, videos, skits, audio tapes, letters to the editor and illustrated maps. Audiences could be elementary students, peers, parents and the local community through school exhibitions, newsletters and neighborhood meetings.

A broader general audience could be reached through businesses, public access television and commercial television public service announcements.

Extension

Students can learn more about local watersheds and water quality by visiting these websites:

The Environmental Protection Agency website is a great resource for locating watersheds in Oregon and has information about water quality in local rivers and streams. visit this website at:

www.epa.gov

This website has detailed maps showing Lane County watersheds, precipitation, streamflow, and salmon habitat along with other information about our area. Visit this website at: http:geography.uoregon.edu/infographics/lcweb/lcindex.htm

Lesson 3: The History of Eugene's Wetlands

In this lesson, students hypothesize which parts of the Eugene area may have been wetlands prior to settlement by European Americans. They will accomplish this by comparing maps of Eugene's present wetlands with historical information. They will then discuss the impact of wetland loss on Eugene's drainage structure and potential for flooding.

Materials

- Wetland Vocabulary Worksheet
- Wetland Definitions Worksheet "Historical Wetlands of the West Eugene Study Area," by Carol Savonen.
- Student version of Eugene wetland map. Copy for each student.
- Overhead made from student version of map of Eugene's wetlands.
- Student Notes *"Eugene's Historical Wetlands."* Copy for each student.
- Classroom map of Eugene's wetlands
- Colored pencils
- Read Historical Wetlands of the West Eugene Study Area document.

Define

Distribute copies of *Wetland Vocabulary* Worksheet and have students define the vocabulary terms using the dictionary, prior knowledge, class discussion and/or teacher help. Refer to the *Wetland Definitions* worksheet.

Discuss

Distribute student version of Eugene wetland map and Student Notes "Eugene's Historical Wetlands." Use the overhead you've made from the student map to lead the class through a discussion. During the discussion, have students find the wetland areas on their maps.

Label

Have students color and label historical wetland areas on their copy of the wetlands map.

Discuss

Through class discussion, have students compare their maps with **the** Classroom Map of Eugene's Wetlands.

Write

Have students write a paper about the history of Eugene's wetlands following this suggested outline:

Paragraph 1: Describe the extent, location and type of wetlands that were in the Eugene area before European Americans arrived.

Paragraph 2: How has this information changed since that time? What do the historical wetland areas look like today?

Paragraph 3: What effects might these changes have on water quality, plant and animal life, and flooding potential?

Lesson 4: The Kalapuyas: Living on the Fertile Prairie

Assign

Hand out *History of the Native Kalapuyas* and *The Kalapuyas: Living on the Fertile Prairie*. Ask students to read both handouts and write out answers to the questions provided at the end of the *History of the Native Kalapuyas* handout.

Discuss

Discuss the history of the native Kalapuyas. Review students' answers to the questions in class.

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Stormwater Pollution: Learn and Share

Values and Functions of Eugene's Local Wetlands

Name: _____

Date: _____

1. _____

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2. _____

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3. _____

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7. _____

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8. _____

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SPLASH!
Stormwater Pollution: Learn and Share

Wetland Vocabulary

Name: _____ Date: _____

1. Hydric Soils _____

_____

2. Riverine _____

_____

3. Surveyors _____

_____

4. Prairie _____

_____

5. Seasonal _____

_____

6. Fallow _____

_____

7. Slough _____

_____

8. Swamp _____

_____

9. Swale _____

_____

10. Tarmac _____

_____

11. Dredge _____

_____

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Stormwater Pollution: Learn and Share

Wetland Definitions

1. Hydric Soils: One of the factors used to define a wetland. When determining whether an area is a wetland or not, wetland specialists look for the presence of soils associated with wet conditions (hydric soils) and for plants that can tolerate saturated soil (hydrophytes).

2. Riverine: One of the five basic types of wetlands. This freshwater wetland type is associated with rivers or streams and is readily found in Eugene. It includes channels or streams of moving water. The other four types of wetlands are:

Marine - sea water wetlands undiluted by freshwater
Estuarine - wetlands in estuaries-areas where saltwater and freshwater mix
Lacustrine - freshwater wetlands associated with lakes
Palustrine - all other freshwater wetlands (swamps, marshes, bogs, etc.)

3. Surveyors: The profession or science of making land surveys. To determine the position, boundaries, area and elevation of a part of the earth's surface by measuring angles and distances. The process of surveying land. A map or plan of surveyed land.

4. Prairie: A wide area of level or rolling grassland that in its natural, uncultivated state usually has deep, fertile soil, a cover of tall, coarse grasses and few trees. Wetland prairies are considered rare and valuable and often host endangered native plants.

5. Seasonal: A period marked by particular activities as in seasonal variations of water levels which impact wetland types and related plant and animal life cycles.

6. Fallow: Plowed but left unsown during a growing season. Marked by inactivity.

7. Slough: A place of deep mud or mire. An inlet on a river. A creek in a marsh or tide flat. A muddy hollow.

8. Swamp: These forested wetlands usually occur along river courses. Their vegetation is dominated by trees and shrubs-cedar, spruce, cottonwood, dogwood, spirea and willows among others. Swamps have dense understories (the vegetation growing beneath the trees), and, with their abundance of food and cover, provide diverse wildlife habitat.

9. Swale: A hollowed depression covered with vegetation which filters dirt, sediment and pollutants away from the water that travels through this shallow waterway.

10. Tarmac: A pavement constructed by spraying or pouring a tar binder over layers of crushed stone that is rolled to compress into a hard surface. Tarmac can also be a material of tar and aggregates mixed in a plant that is layed down on the roadway with special equipment. Tarmac is an impervious surface through which rainwater cannot penetrate which encourages runoff.

11. Dredge: A machine used to remove sand or mud from the bottom of a body of water. Dredge also means to clean, deepen or widen by removing earth.

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Stormwater Pollution: Learn and Share

Historical Wetlands: Student Notes

Introduction: The following excerpts were taken from "Historical Wetlands of the West Eugene Study Area." This paper was written by Carol Savonen in April 1988 through a contract with the Lane Council of Governments.

Key Points:

- The majority of the flatter areas below the elevation of 400 feet that have hydric soils were probably historical wetlands.
- Surveyors who measured the Willamette Valley in 1852-1853 reported that many of the prairie flats west of Eugene were seasonally covered with up to three feet of water.
- "There have been countless changes in the west Eugene landscape since the time of European settlement, especially to wetlands. Wet prairies were plowed, drained and planted. Others were grazed and let lie fallow without the clearing benefit of fire. Ash, oak and eventually Douglas fir took the place of the original prairie. Bottom land and (surrounding) woodlands were logged. Sloughs and swamps were dredged or filled in. Creeks were culverted and channelized and rivers were dammed. Now much of the landscape is barely recognizable through the tarmac, shopping centers and neighborhoods."
- Many small streams found on 1910 maps no longer exist.
- The following wetlands were recorded by surveyors in 1852-1853:

  A) An ash willow swale over 215 feet wide and two miles long along what is now City View Street.

  B) An ash willow swale over 250 feet wide next to Bailey Hill Road and Amazon Creek.

  C) Wet prairies sometimes covered with 1-3 feet of flood water were found in the Willow Creek area between Bailey Hill and Bertelsen Streets and between West 11th and West 18th Avenues.

  D) A slough that was over 900 feet wide was found just north of Fifth Avenue and between Seneca and Bertelsen Roads.

  E) A shrub swale over 100 feet wide in the Echo Hollow Road area.

  F) Seasonally flooded areas in the west Eugene areas of Danebo Street and Royal Avenue.

  G) Seasonally flooded wet prairies in the Green Hill Road area between West 11th Avenue and the Eugene Airport and between Green Hill Road and Beltline Road.

  H) Most of the flat area in west Eugene was seasonally flooded.

  I) A slough near Colin Kelly Middle School was approximately 100 feet wide.

  J) The Eugene Airport area was wet prairie meadow.

SPLASH!

Stormwater Pollution: Learn and Share

Additional Resources

This segment of the curriculum lists reference sites, community resources, music, visual aids, and literature to help you with ideas for supplementing the lessons.

Additional Resources

Community Resources

OREGON STATE DEPARTMENT OF FISH AND WILDLIFE
Field Office, 3150 East Main Street
Springfield, OR 97477
Contact: Dan Van Dyke 726-3515

EUGENE WATER & ELECTRIC BOARD
500 East 4th Avenue
P.O. Box 10148
Eugene, OR 97440-2148
Contact: John Femal 341-8528

McKENZIE FLYFISHERS
P.O. Box 10865
Eugene, OR 97440-2465
Contact: Gail Campbell 683-4420

CASCADE FAMILY FLYFISHERS
P.O. Box 70453
Eugene, OR 97401
Contact: Ron Davis 744-0066

OREGON STATE UNIVERSITY/
LANE COUNTY EXTENSION SERVICE
950 West 13th Avenue
Eugene, OR 97401
Contact: Roxanne Emmons or Ross Penhallegon 682-4243

Community Resources

CITY OF EUGENE

Stormwater Education and Outreach
www.eugene-or.gov/stormwater
858 Pearl Street
Eugene, OR 9740l
Contact: Kathy Eva 682-2739

Wastewater Treatment Plant
410 River Avenue
Eugene, OR 97401
Contact: Bob Sprick 682-8617

Eugene Stream Team
1820 Roosevelt Boulevard
Eugene, OR 97402
Contact: Mike Bellmore 682-4850

WILLAMETTE RESOURCE AND EDUCATIONAL NETWORK (WREN)
www.wewetlands.org
751 S. Danebo Ave
Eugene, OR 97402
541-683-6494

NEARBY NATURE
www.nearbynature.org
P.O. Box 3678
Eugene, OR 97403
(541) 687-9699

Additional Resources for Grades K-5

Additional Reference Materials

US Environmental Protection Agency
www.epa.gov/owow
Check out the "Watersheds for Kids" section for some online activities. Great fact sheets and information for all grade levels throughout the site.

The Pacific Rivers Council
www.pacificrivers.org
P O Box 10798, 2895 Oak Street, Eugene OR 97440. Phone 345-0119.
Contact: David Bayles

Sea Grant Education Program
www.seagranted.net
Mark O. Hatfield Marine Science Center, 2030 South Marine Science Drive, Newport OR 97365. Phone (541) 867-0271.

The Water Sourcebook
www.wef.org under the "About Water and Sanitation" drop down
A series of classroom activities for grades 3-5 developed by the Water Environment Federation, 601 Wythe Street, Alexandria VA 22314-1994 USA. Phone (800) 666-0206.

WET/Water Education for Teachers
www.projectwet.org
Project WET Activity Guide
Resources for water education for teachers, community members and professionals.

The Nature Conservancy
www.nature.org
Amazing photographs and stories about conservation efforts around the globe, mostly geared to older students. Also an activities section available through free subscription.

Music

Baby Beluga by Raffi and D. Pike, 1980, Homeland Publishing, A Division of Troubadour Records Ltd., "Baby Beluga" (whale).

Habitat by Bill Oliver

Itsy Bitsy Spider, traditional folk song

Lullaby by Chris Williams, 1977, Bird Ankles Music, on "Live Dream" album.

Old McKenzie View by Chuck Messinger, 1993, Michael Cooper Studio, on "Follow the Wolf" album.

On Your Way Home by Luther Schutz, Motherlode Music, from "Everything Possible" album.

Raindrops are Falling on My Head

River by Bill Stains, Mineral River Music, on "Bridges" album.

Sailing Down This Golden River by Pete Seeger, 1971, Melody Trails, Inc., on "Rainbow Race" album.

Save Our Planet by Neal Gladstone.

The Water is Wide performed by Pete Seeger, on "American Favorite Ballads" album.

Watching the River Run by Loggins and Messina, 1973, Portofino Music, CBS Inc.

Waterfall by Chris Williams, Bird Ankles Music, 1975, on "Changer and the Changed" album.

Well May the World Go by Pete Seeger.

What Have They Done to the Rain? by Malvina Reynolds, 1962, Schroder Music, on "Held Over" and "Sings the Truth" albums.

Note: Words and music for many songs listed above may be found in the "Rise Up Singing Songbook", Edited by Peter Blood-Patterson, a Sing Out Publication, Bethlehem PA, 1988.

Video

Videos available for check-out from these agencies:

CITY OF EUGENE, PUBLIC WORKS ADMINISTRATION
858 Pearl Street, 4th Floor, Eugene OR 97401-2727
Contact: Kathy Eva, Stormwater Information, 682-2739

"The Wealth in Wetlands"
Running time: 23 minutes. Audience: Age 8 and up. A brief history of wetlands in the United States with discussion from farmers about how they manage their crops and wetlands. Developed in 1991 by the National Association of Conservation Districts, US Department of Agriculture and Soil Conservation Service, Successful Farming magazine, Ducks Unlimited, Inc., US Department of the Interior Fish and Wildlife Service, and the National Fish and Wildlife Foundation.

"Luck Isn't Enough: The Fight for Clean Water"
Running time: 12 minutes. Audience: Age 8 and up. Content based in New York and Connecticut, but subject matter suitable for general viewing. Defines "nonpoint source pollution" as the leading cause of water quality destruction and how we are each responsible, whether we live near a water body or not. Shows everyday examples of nonpoint source pollution and ideas to make a difference.

"Fabulous Wetlands"
Running time: 7 minutes. Audience: Elementary and Middle School. Hosted by Bill Nye, the Science Guy from Public Broadcast System fame. This comedic, approach with a science base, addresses the many benefits of wet-lands and how our actions affect water quality. Developed in 1989 by the Washington State Department of Ecology. Available at the Eugene Public Library.

"Down the Drain"
Running time: 30 minutes. Audience: Elementary and Middle School. One in a series of special focus programs as part of the "3-2-1 Contact" Children's Television Workshop. Hosted by young news reporter Stephanie Yu who leads viewers along the water cycle to find out how water gets dirty, how it gets clean, and what we can do to help conserve and preserve it. Uses music, animation, and location shots along the way.

Video

Water Environment Federation Curriculum Program
Audience: Grades 5-9. The following five videos were developed as individual units which contain a video, a teacher's guide with suggestions for hands-on classroom activities, and student guides to reinforce the concepts presented. An animated "spokes-dinosaur," music video-style presentations, and a video game format are some of the features the Water Environment Curriculum Program uses to teach students about water quality. The program consists of four units on different aspects of water quality. Each unit contains a video, a teacher's guide with suggestions for hands-on classroom activities, and student guides to reinforce the concepts presented. To obtain the supplemental materials for use in your classroom, contact: Water Environment Federation, 601 Wythe Street, Alexandria VA 22314-1994. Phone: 800-666-0206 or 703-684-2400.

"Saving Water: The Conservation Unit"
Running time: 8 minutes 26 seconds. Description: Imagine a visit to a museum of the future. Curator Dino Sorrus explains how all the earth's water, except for one small vial, has been wasted or polluted beyond use. Students see what might happen tomorrow—unless they begin preserving our water supply today.

"The Groundwater Adventure Unit"
Running time: 9 minutes 42 seconds. Description: The often puzzling concept of groundwater is explained with a video game format and game-master Dino Sorrus. An on-screen student gains points by preventing groundwater pollution from industrial, agricultural, and private residential sources. However, students learn that preventing groundwater pollution is not just a game—it's something they should do every day.

"The Wastewater Treatment Unit"
Running time: 11 minutes 15 seconds. Description: This entertaining video presents a complete overview of the wastewater treatment process, explains to students how they are affected, and spells out what they can do to promote clean water.

"The Surface Water Unit"
Running time: 11 minutes 15 seconds. Description: Students will examine water quality issues and learn how the water cycle works, along with Dino Sorrus and live-action students. Reports from the field on the state of today's surface water quality to give students ideas on how to prevent water pollution.

Video

"Speaking for Wetlands"
Running Time: 14 minutes 40 seconds. Description: Locally produced video focuses on the values and functions of wetlands. It also demonstrate how volunteers can take action to protect and enhance our local waterways. Produced and filmed in Eugene.

"Frogline Video"
Running time: 8 minutes. Audience: Upper elementary. Fast-paced and humorous. Covers nonpoint source pollution in a news format. Anchor amphibians Finneas Frog and Kris Kroak describe how nonpoint source pollution impacts the environment and discuss what individuals can do to reduce or prevent this pollution.

Available from LANE COUNTY EDUCATIONAL SERVICE DISTRICT
P.O. Box 2680, Eugene, OR 97401

Media and film booking. Phone 461-8220.

MA900676 *Water: A First Film*
MA750420 *Our Round Earth: Its Water*
MB830201 *Rivers: The Work of Running Water*
MB900674 *Waves on Water*

Available from the OREGON DEPARTMENT OF FISH AND WILDLIFE field office, 3150 East Main Street, Springfiled, OR 97477. Phone 726-3515

Storm Drain Marking
The Future of our Green Rivers
Conserving America: The Rivers
Conserving America: The Wetlands

Websites

Ranger Rick's Kids' Zone
A website with an environmental focus for kids. Educational games, outside activities, magazines and more at www.nwf.org/kids/

Exploring Ecosystems
A website that lets students explore different ecosystems including the Sonoran desert and the Everglades.
www.harcourtschool.com/activity/exploring_ecosystems/index.html

United States Environmental Protection Agency Explorers' Club
A website that teaches kids about pollution, conservation and recycling.
http://www.epa.gov/kids/

Wetland Kids Page
A fun website all about wetlands. The website includes activities, vocabulary and links to related websites.
http://www.wetland.org/

ExplorA-Pond
Very well-designed website that lets students explore a pond ecosystem, adopt a pond and access a virtual pond.
http://www.uen.org/utahlink/pond/

Darby Duck and The Aquatic Crusaders
The Environmental Protection Agency's nonpoint source pollution kids page includes water experiments and information about stormwater pollution.
http://www.epa.gov/OWOW/NPS/kids/DARBY.HTM

Literature

CALL NUMBER: EUGENE PL = 628.2 EU431t
TITLE: *Comprehensive Stormwater Management Plan (CSWMP)* Technical report/City of Eugene. PUBLISHED: Eugene OR: The City, 1993.

CALL NUMBER: EUGENE PL= + 333.918 C351d
AUTHOR: Challand, Helen J
TITLE: *Disappearing Wetlands/*Helen J. Challand; technical consultant, Milton W. Weller.
PUBLISHED: Chicago : Children's Press, c1992. 172 p.:ill. (some col.); 25 cm.
SUMMARY: Examines the ecological role of wetlands and discusses how they are formed, what life they support, and how people modify or destroy them.

CALL NUMBER: EUGENE PL= + 553.7 D649
TITLE: *Do Fish Drink?*: first questions and answers about water.
PUBLISHED: Alexandria, Va. : Time-Life for Children, 1993. 1 v. (unpaged) : col. ill. ; 29 cm.
SUMMARY: Discusses, in question-and-answer format, the sources, cycle, and uses of water, why oceans are salty, and other related topics. Includes simple experiments.

AUTHOR: Dorros, Arthur.
TITLE: *Follow the Water from Brook to Ocean/*written and illustrated by Arthur Doros. 1st ed.
PUBLISHED: New York : HarperCollins, 1991. 32 p. : col. ill. ; 19 x 24 cm.
SUMMARY: Explains how water flows from brooks, to streams, to rivers, over waterfalls, through canyons and dams, to eventually reach the ocean.

CALL NUMBER: EUGENE PL = 363.61 Or3o Vol 1992
TITLE: *Oregon's Drinking Water Program*: summary report.
PUBLISHED: Portland, Or. : Dept. of Human Resources, Health Division, Office of Environment and Health Systems, Drinking Water Section, [1983-1984]

AUTHOR: Symons, James M.
TITLE: *Plain Talk About Drinking Water: Answers to 101 Important Questions About the Water You Drink* / by James M. Symons.
PUBLISHED: Boulder, CO : American Water Works Association, c1992.

Literature

CALL NUMBER: EUGENE PL = + 591.929 T212r
AUTHOR: Taylor, Barbara
TITLE: *River Life* / photographed by Frank Greenaway; written by Barbara Taylor. 1st American ed. PUBLISHED: New York : D. Kindersley, Inc., 1992. 29 p. : col. ill. ; 26 cm.
SUMMARY: Examines, in text and photographs, the animals and plants that live in and along a river.
NOTES: Includes index.

CALL NUMBER: EUGENE PL = + 363.7394 H653r
AUTHOR: Hoff, Mary King.
TITLE: *Rivers and Lakes* / Mary Hoff and Mary M. Rodgers.
PUBLISHED: Minneapolis : Lerner Publications Co., c1991. 64 p. : col. ill. ; 21 x 23 cm.
SUMMARY: Alerts the reader to the dangers of surface water pollution and the global imperative to keep these waters fresh.
NOTES: Includes index.

CALL NUMBER: EUGENE PL = + 551.473 T212r
AUTHOR: Taylor, Barbara
TITLE: Rivers and Oceans / Barbara Taylor. 1st American ed.
PUBLISHED: New York : Kingfisher Books, 1993. 31 p. : col. ill. ; 24 cm.
SUMMARY: Introduces the different forms of water in our world; the water cycle; stages in the life of a river; ocean currents, waves, and tides; lakes; and water pollution.
NOTES: Includes index.

CALL NUMBER: EUGENE PL = + 551.483 SI25r
AUTHOR: Sleep, Mark C. W.
TITLE: *Rivers and Streams* / Mark C.W. Sleep.
PUBLISHED: Hove, England : Wayland, 1983. 32 p. : col. ill. ; 24 cm.
NOTES: Includes index.

CALL NUMBER: EUGENE PL = + 574.526325 H616s
AUTHOR: Hirschi, Ron.
TITLE: *Save our Wetlands* / Ron Hirschi ; photographs by Erwin and Peggy Bauer.
PUBLISHED: New York : Delacorte Press, 1994. x, 63 p. : col. ill. ; 24 cm.
NOTES: National Audubon Society, an Audubon book"—cover. Includes index.

Literature

CALL NUMBER: EUGENE PL = + 628.1 C634t
AUTHOR: Cobb, Vicki.
TITLE: *The Trip of a Drip* / by Vicki Cobb ; illustrated by Elliot Kreloff. 1st ed.
PUBLISHED: Boston : Little, Brown, c1986. 50 p. : ill. ; 21 cm.
NOTES: Traces the journey water makes from, to, and through our homes.

CALL NUMBER: EUGENE PL = + 553.7 K727w
AUTHOR: Knapp, Brian J.
TITLE: *Water* / [contributory author: Brian Knapp ; illustrators: Tim Smith and Mark Franklin].
NOTES: Includes index.

CALL NUMBER: EUGENE PL = + 551.48 T215w
AUTHOR: Taylor, Kim.
TITLE: *Water* / written and photographed by Kim Taylor. U.S. ed.
PUBLISHED: New York : J. Wiley, c1992. 32 p. : col. ill. ; 29 cm.

CALL NUMBER: EUGENE PL = + 363.7394 On2w
AUTHOR: O'Neill, Mary (Le Duc)
TITLE: *Water Squeeze* / by Mary O'Neill ; illustrated by John Bindon.
PUBLISHED: Mahwah, N.J. : Troll Associates, c1991. 32 p. ; 28 cm.
SUMMARY: Discusses the importance of water in our lives and the dangers we create when we pollute the waters of the planet.

CALL NUMBER: EUGENE PL = + 551.48 W154w
AUTHOR: Walker, Sally M.
TITLE: *Water Up, Water Down* : The Hydrologic Cycles / by Sally M. Walker.
PUBLISHED: Minneapolis : Carolrhoda Books, c1992. 47 p. : ill. (come col.) ; 24 cm.
SUMMARY: Describes the hydrologic cycle and its importance to live on Earth.
NOTES: "A Carolrhoda earth watch book." Includes index.

CALL NUMBER: EUGENE PL = + 553.7 J648w
AUTHOR: Johnston, Tom.
TITLE: *Water, Water!* / Tom Johnston ; illustrated by Sarah Pooley. North American ed.
PUBLISHED: Milwaukee : G. Stevens Pub., 1988. 32 p. ; 24 cm.
NOTES: Rev. ed. of: Let's Imagine, Water. 1985. Includes index. Demonstrates the many uses of water, where it comes from, how it is wasted, and why it is vital to the survival of living things.

Literature

CALL NUMBER: EUGENE PL = + 551.48 R194w
AUTHOR: Rauzon, Mark J.
TITLE: *Water, Water Everywhere /* by Mark Rauzon and Cynthia Overbeck Bix. 1st ed.
PUBLISHED: San Francisco : Sierra Club Books for Children, c1994. 32 p. : col. ill. ; 20 x 24 cm.
SUMMARY: Describes the forms water takes, how it has shaped Earth, and its importance to life.

AUTHOR: Amsel, Sheri.
TITLE: *A Wetland Walk /* written and illustrated by Sheri Amsel.
PUBLISHED: Brookfield, Conn. : Millbrook Press, c1993. 1 v. (unpaged) : col. ill. ; 26 cm.
SUMMARY: Illustrations and rhyming text depict a day-long walk through a marsh and introduce the plants and animals of a wetland environment.
NOTES: Includes bibliographical references and index.

AUTHOR: Peters, Lisa Westberg.
TITLE: *Water's Way /* by Lisa Westberg peters ; illustrated by Ted Rand. 1st ed.
PUBLISHED: New York, N.Y. : Arcade, 1991. [32] p. : col. ill. ; 24 cm.
SUMMARY: Introduces the different forms that water can have, from clouds to steam.

CALL NUMBER: EUGENE PL = + 553.7 Se45w
AUTHOR: Seixas, Judith S.
TITLE: *Water—What it is, What it Does /* Judith S. Seixas ; illustrated by Tom Huffman. 1st ed.
PUBLISHED: New York : Greenwillow Books, c1987. 56 p. : ill. ; 22 cm.
NOTES: A simple introduction to water, describing its properties, uses, and interaction with people and the environment. Includes five basic experiments.

CALL NUMBER: EUGENE PL = + 574.526325 R671w
AUTHOR: Rood, Ronald N.
TITLE: *Wetlands /* by Ronald Rood ; illustrated by Marlene Hill Donnelly. 1st ed.
PUBLISHED: New York : HarperCollins Publishers, c1994. 48 p. : col. ill. ; 24 cm.
SUMMARY: Introduces the many kinds of plants and animals found in freshwater wetlands, including flycatchers, whirligig beetles, and tiny water fleas and worms.

CALL NUMBER: EUGENE PL = + 551.48 K126w
AUTHOR: Kalman, Bobbie
TITLE: *Wonderful Water /* Bobbie Kalman & Janine Schaub.
PUBLISHED: Toronto : Crabtree Pub., c1992. 31 p. : col. ill. ; 28 cm.
NOTES: Includes index.

Additional Resources for Grades 6-8

Curricula

Wading Into Wetlands - 64 pages, NatureScope publication, contains elementary/junior high school level activities and information on saltwater and freshwater wetlands, how they have been abused and what can be done to protect them. Order fromMcGraw Hill, P.O. Box 548, Blacklick, OH 43004, (800) 262-4729, (1992).

Earth Day Every Day, Teacher's Kit, United States Environmental Protection Agency, Public Information Center, 401 M Street SW, Washington DC 20460.

Exploring Planet Water, curriculum provided with in-service to teachers. Eugene Water and Electric Board Water Management Services, P.O. Box 10148, Eugene, OR 97440, Phone (541) 984-4706

Always a River: Supplemental Environmental Education Curriculum on the Ohio River and Water - 284 page notebook for grades K-12 includes 58 activities on the water cycle, wastewater treatment and other topics. Order from U.S. EPA, OR&D, Center for Environmental Learning, 26 West Martin Luther King Drive, Cincinnati OH 45268, (1991).

Discover Wetlands - activity guide for grades 4-12, topics include definition of wetlands, wetland field studies, the functions of wetlands and human impacts on wetlands. Order from Washington State Department of Ecology, Publications, P.O. Box 47600, Olympia WA 98504, (360) 407-7472 or www.ecy.wa.gov/programs/sea/shorelan.html. $18.00 (1988).

Gee-Wow! Adventures in Water Education - includes 28 activities and a video for grades K-6, topics include water, groundwater and pollution prevention. Order from Ecology Center, 417 Detroit Street, Ann Arbor MI 48104, (734) 761-3186, (1991).

Curricula

The Stream Scene: Watersheds, Wildlife and People -546 page notebook contains activities about watersheds, water quality and aquatic organisms. Order from Oregon Department of Fish and Wildlife, Office of Public Affairs, 2501 SW First Avenue, Portland OR 97201, (503) 872-5264 x5366, (1992).

Wow! The Wonders of Wetlands - 160 pages, grades K-12, topics include wetland types, plants and animals, soils, functions, values and protection. Order from Environmental Concern, Inc., P. O. Box P, St. Michaels MD 21663 (410) 745-9620, (1991).

Wetnet - wetlands environmental curriculum contains complete lesson plans as the foundation for complete unit; lesson plans include learning objectives and hands-on, applied activities and discussion questions. Grades 5-7. The Adirondack Teacher Center, P. O. Box 3000, Paul Smiths, NY 12970 (518) 327-3000 or (518) 327-5012.

Waterchamps - regional water quality curriculum for middle school (grades 5-8): biology, hydrology. Written as an interdisciplinary activity: water pollution testing, etc. very hands-on, applied activities. The Adirondack Teacher Center, P. O. Box 3000, Paul Smiths, NY 12970 (518) 327-3000 or (518) 327-5012.

POW - The Planning of Wetlands - POW guides educators in creating, restoring, enhancing and monitoring with students. Order from Environmental Concern, Inc. P.O. Box P, St. Michaels, MD 21663. (410) 745-9620. www.wetland.org/kids/Kids.htm.

Walking the Wetlands: A Hiker's Guide to Common Plants and Animals of Marshes, Bogs and Swamps - 222 pages, Janet Lyons and Sandra Jorden. Includes sections on the plant and animal kingdoms, illustrations, glossary, bibliography and index. Order from John Wiley and Sons, Business/Law/General Books Division, 605 Third Avenue, New York NY 10158-0012.

Books

Clean Water in Your Watershed: A Citizens' Guide to Watershed Protection - Focusing on the citizens' role in protecting watersheds, this colorfully illustrated guide helps citizen groups work with local, state and federal government agencies to successfully design and complete a watershed protection or restoration project. Order from Terrene Institute, 4 Herbert Street, Alexandria, VA 22305. (703) 548-5473.

Exploring the Great Swamp, George Laycock. David McKay Company, Inc.; 1978; 58 p.; grades 5-8; nonfiction. Informative, well-illustrated, and conveys a sense of intrigue and adventure as wetlands are defined along with some of their values and functions.

Look What I Found, Marshal T. Case. The Chatham Press, Inc., Riverside; 1971; 95 p.; grades 5-7; nonfiction. Contains useful information on setting up an aquarium either at home or in the classroom for studying plant and animal life including those found along the edge of wetlands. Discourages disturbing wetlands and encourages students to release living things they capture to their native habitats once finished with them.

Of Men and Marshes, Paul L. Errington. The Iowa State University Press, Ames; 1957; 150 p.; grades 7-10; nonfiction. Accurate but not too technical description as dedicated naturalist unveils little-known world of wetlands life; encompasses prairie marshes and marsh-dwelling animal societies such as the muskrat and water birds. Describes living things adjusting to changes such as muskrats during flood and drought and waterfowl in migration during a snow storm.

Pond Life, George K. Reid, Ph.D. Western Publishing Company, Inc., New York; 1967; 160 p.; grades 6-10; index; nonfiction. Popular, accurate and informative book in the Golden Guide Series. Describes and illustrates in color some of the most common of the thousands of animals and plants that inhabit ponds and other wetlands, lakes and streams. First section includes valuable information on the characteristics of ponds, examining several of the many different types of ponds and wetlands (cypress swamps, bogs and mountain bogs). Discusses water characteristics and the different habitats found in freshwater systems, including the wetland habitat extending from the water's edge outward - as far as rooted plants grow. Suggestions for when to visit, where to look, how to make exciting discoveries and how to observe, collect and release live specimens.

The Wind in the Willows, Kenneth Grahame. Charles Scribner's Sons, New York; 1908; 259 p.; grades 6-10; fiction. Classic, delightful story featuring adventures of animals along a riverbank, wetlands habitats and other low-lying areas. The Wind in the Willows portrays the interconnectedness of wetlands, rivers, meadows, woods and the lives of animals and humans.

Miscellaneous

Wetlands Watch Kit - packet contains fact sheets on wetlands ecosystems, Section 404 of the Clean Water Act, kid's flyer, resource lists and more. Order from Izaak Walton League of America, 1401 Wilson Boulevard, Level B, Arlington VA 22209-2318, FAX (703) 528-1818, (1990).

Careers in Water Quality Brochure (grades 7-12) - describes career opportunities in water quality including engineering, management, operations, research, regulation and public interest. The interests, skills and educational training required for each career are also explained. Order from Water Environment Federation, 601 Wythe Street, Alexandria VA 22314-1994, (800)
666-0206.

Bottle Biology - Describes how students can build classroom biology projects on composting, wetlands, sedimentation, etc. with large empty plastic pop bottles to teach about science and the environment. Detailed information is available of the University of Wisconsin - Madison's website, www.fastplants.org.

Wetlands Information Hotline - wetlands hotline, information and publications. Toll free telephone service for public interest questions and requests for information on wetlands functions, values and options for protection. Central point of contact for Outreach and State Programs section in the Wetlands Division at EPA; provides wide variety of publications and oral information including Wetlands Reading List (pre-K-12) and Wetlands Information Resource Guide. Hours of operation are 9 a.m. to 5:30 p.m. EST. Contractor operated for the U.S. Environmental Protection Agency.

Hayden Bridge Water Filtration Plant Tours, Eugene Water and Electric Board, (541) 341-8526

Video

Life on the Edge, Improving Riparian Function - 12-minute video presentation that focuses on the pivotal role of riparian areas in a watershed. Produced by Oregon State University (1999). Available from the Lane County Extension Service.

It's Found Underground - 30-minute video. 3 segments: Water and You, Groundwater, Trouble and Trash. Study Guide for teachers is available. Order from Ecology Center, 417 Detroit Street, Ann Arbor MI 48104, (734) 761-3186, (1991).

Aquatic Plant Identification - 7-part instructional
videotape series teaches non-botanists how to identify more than 100 freshwater aquatic plants. Order from Information Office, Center for Aquatic Plants, 7922 NW 71st Street, Gainesville FL 32606, (904) 392-1799.

Journey of the Blob - 10-minute video demonstrates how the community's water cycle works when a boy disposes of a green blob in the sink. Raises many questions about environmental responsibility. Order from Bullfrog Films, Inc., P.O. Box 149, Oley PA 19547, (800) 534-3764.

A World in Our Backyard: A Wetlands Education and Stewardship Program - 3-part multi-media education package – teacher/student videos/teacher workbook. Helps teachers and students to understand wetlands and protect them in their own communities. Environmental Media Corporation; to borrow, call EPA Region 1 library, (617) 565-3300, or New England Aquarium, (617) 973-6590. Grades 5-12.

Fabulous Wetlands - VHS video featuring "The Science Guy" from PBS and focusing on wetlands protection. Grades 5-12. Available from 4J School District ISD.

Let's Explore a Wetland - 17-minute color video canoe trip teaches swamp ecosystem, including web that interrelates its inhabitants. Includes teacher's guide. Grades 4-12. National Geographic Society, Education Services, P.O. Box 10579, Des Moines, IA 50340, (800) 368-2728.

Speaking for Wetlands - Running time: 14 minutes, 40 seconds. Description: Locally produced video focuses on the values and functions of wetlands. It also demonstrates how volunteers can take action to protect & enhance our local waterways. Produced and filmed in Eugene.